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SYNOPSIS

OF THE

CLASSIFICATION OF THE ANIMAL KINGDOM

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BY

HENRY ALLEYNE NICHOLSON

MD., D.Sc., Ph.D., F.L.S., F.G.S., Etc.

REGIUS PROFESSOR OF NATURAL HISTORY IN THE
UNIVERSITY OF ABERDEEN

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PREFACE.

Having often been requested by students of Natural History to prepare a synoptical table of the classification of the Animal Kingdom, the present work is an attempt to comply with this requisition, and to supply what the author believes to be a want among zoological workers. Nothing more, of course, could be attempted in the preparation of such a synoptical table than an enumeration of the sub-kingdoms, classes, orders, and sub-orders, with, in general, the *families*, and the principal genera illustrative of these. It has not been possible, however, without unduly extending the limits of the work, to mention in all cases *all* the families, and this deficiency is especially noticeable in the case of such great groups as the Insects, the Fishes, and the Birds. It has also seemed advisable not to give *definitions*, even of the shortest sort, of the subdivisions which are actually enumerated, except in the case of the sub-kingdoms only. It is hardly possible to make such definitions satisfactory within the limits here available; and the introduction of definitions might possibly have led to an abuse of what is really intended to be a mere *guide to a line of study*, and not a thing to be studied in itself.

While definitions have been omitted, a limited number of illustrations have been introduced, as self-explanatory of the text. Occasionally, also, remarks on doubtful points, or divergent views as to classification, are introduced, or alternative arrangements are submitted; and there are added to each group references to some of the sources of special information, which can be studied by advanced students. It seems hardly necessary to add that the purpose of such a classification as is here given, is not that it should be, even in parts, committed to memory, but simply that it may serve as a skeleton, which the student must endow with life by his own work.

MARISCHAL COLLEGE, ABERDEEN,
July 5, 1882.

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SYNOPSIS

OF THE

CLASSIFICATION OF THE ANIMAL KINGDOM.

SUB-KINGDOM (TYPE) I.—PROTOZOA.

(Extinct forms are marked with an asterisk.)

ANIMALS composed of undifferentiated protoplasm, or, at most, of protoplasm which is so far differentiated as to have developed a consistent external layer or wall and a central "nucleus" or "endoplast," the organism in the latter case becoming a "cell." In the most typical *Protozoa* the organism remains unicellular, and in no case are definite "tissues" developed by the differentiation of a primitive cellular aggregate. No definite "body-cavity" is in any case developed. There is no recognisable nervous system, and there is either no differentiated alimentary apparatus, or, at most, a rudimentary one.

Most naturalists now divide the animal kingdom into the two primary sections of the *Protozoa* and the *Metazoa;* the former comprising animals which are essentially unicellular, or consist of simple undifferentiated masses of sarcode—while the latter comprises animals which commence their existence as single cells, but which ultimately form cellular aggregates, certain of the cells composing them being differentiated so as to form definite "tissues." The *Protozoa* and *Metazoa* agree, therefore, with one another in the fact that they are, to begin with, simple undivided masses of protoplasm, but they differ in the results produced by the development of this protoplasm. In the case of the *Protozoa*, the original mass of protoplasm may remain undifferentiated, or it may develop a "nucleus," and become thus a "cell;" but it does not become converted into a complex structure composed of metamorphosed cells or "tissues." On the other hand, in the *Metazoa*, the original mass of protoplasm is not only always a true cell, but it becomes converted by a process of regular division into a primitive aggregate of cells, and these secondary cells become finally differentiated into the complex "tissues" of which the body of the adult is composed.

The principal difficulty in the way of accepting this primary, and in the main natural, division of the animal kingdom, is afforded by the Sponges, which are morphologically *Protozoa*, while, according to the views of many naturalists, they are developmentally *Metazoa*. That is to say, they present in their morphological elements so close a resemblance to certain of the *Protozoa* that we can hardly doubt of their close genetic connection with the latter; while, on the other hand, they exhibit in their development (as this has been usually interpreted) the "segmentation" of the primitive ovular cell which is characteristic of the *Metazoa*. Whether or not they possess any definite internal vacuity which can be properly compared with the "body-cavity" of the normal *Metazoa* may still legitimately remain a matter for doubt. It is also still a matter of reasonable doubt whether the development of the Sponges is really properly comparable to that of the *Metazoa;* and, if we accept the views of Mr Saville Kent upon this subject, it certainly is not so. It should also be borne in mind that there are certain of the *Protozoa* (*e.g.*, some of the *Radiolaria*) in which it is not possible to absolutely assert that the adult is unicellular.

As regards the primary divisions of the *Protozoa*, it has not been unusual to accept the presence of a permanent *mouth*, or ingestive aperture, as a good mark of distinction; and, in accordance with this, the *Protozoa* have been divided into the two primary sections of the *Astomata* (comprising the *Gregarinida* and *Rhizopoda*), and the mouth-bearing forms, or *Stomatoda* (comprising the *Infusoria*). Many of the *Infusoria*, however, do not possess a mouth in the proper sense of the term; and Mr Saville Kent has recently ('Manual of Infusoria') proposed the following classification of the *Protozoa*, based upon a more accurate interpretation of the methods in which the ingestion of food is effected by different members of the sub-kingdom:—

SECTION A, PANTOSTOMATA.—Ingestive area diffuse. This section comprises the *Gregarinida* and the most typical forms of the *Rhizopoda* (viz., the *Amœbea*, *Monera*, *Foraminifera*, and *Radiolaria.*)

SECTION B, DISCOSTOMATA.—Ingestive area discoidal, not constituting a distinct mouth. The principal forms included in this section are the Flagellate Infusoria and the Sponges.

SECTION C, EUSTOMATA.—Ingestive area taking the form of a distinct mouth. This section comprises only the Ciliated Infusoria.

SECTION D, POLYSTOMATA.—Ingestive areas distinct and multiple. This section contains only the Suctorial Infusoria.

CLASS I.—GREGARINIDA.

ORDER I.—MONOCYSTIDEA.—*Monocystis* (fig. 1, B).
ORDER II.—EUGREGARINIDA.—*Gregarina* (fig. 1, A and C).
ORDER III.—ACANTHOPHORA.—*Stylorhynchus.*
ORDER IV.—DIDYMOPHYIDA.—*Didymophyes* (perhaps founded upon conjugated forms).

(Kölliker, *Beiträge zur Kenntniss niedere Thiere* (*die Gattung Gregarina*), Zeitschr. für Wiss. Zool., 1849 ; Stein, *Untersuchungen über die Gregarinen*, Archiv für Anat. und Physiol., 1848, and Zeitschr. für Wiss. Zool., 1851 ; Schneider, *Gregarines des Invertébrés*, Arch. Zool. Exper., 1873 and 1875 ; Bütschli, *Kleine Beiträge zur Kenntniss der Gregarinen*, Zeitschr. für Wiss. Zool., 1881.)

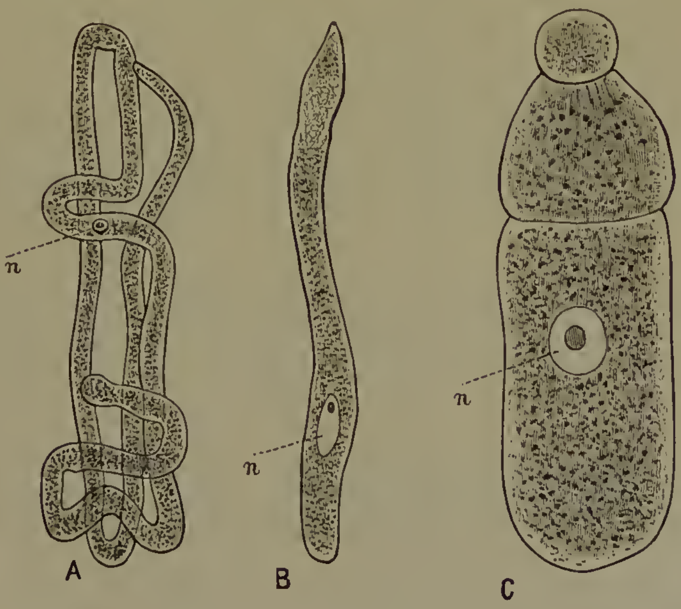

Fig. 1.—Gregarinida. A, *Gregarina gigantea*, parasitic in the Lobster, enlarged, after Van Beneden. B, *Monocystis magna*, parasitic in the Earthworm, enlarged. C, An immature individual of *Gregarina blattarum*, greatly enlarged, after Bütschli, showing the separation of the body into an anterior, middle, and posterior portion : *n*, Nucleus.

CLASS II.—RHIZOPODA.[1]

ORDER I.—MONERA.

Sub-ord. 1. Gymnomonera.—*Protamœba* (fig. 2), *Myxodictyon.*

Sub-ord. 2. Lepomonera.—*Protomyxa, Myxastrum.*

(Hæckel, *Studien über Moneren und andere Protisten*, 1870; Cienkowski, *Beiträge zur Kenntniss der Moneren*, Archiv für Mikros. Anat., 1865.)

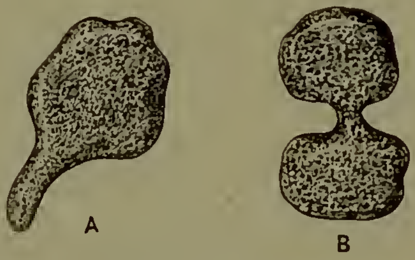

Fig. 2.—Monera. *Protamœba primitiva*, enlarged, after Hæckel. A, An individual with a single pseudopodium protruded; B, Another individual dividing by fission into two portions.

ORDER II.—AMŒBEA (Lobosa).

Sub-ord. 1. Amœbina.—*Amœba* (fig. 3), *Mastigamœba, Pelomyxa.*

Sub-ord. 2. Arcellina.—*Arcella, Difflugia, Hyalosphenia, Quadrula.*

Hertwig and Lesser place the *Arcellina* along with *Gromia* and the *Foraminifera* in a common division, to which they give the name of *Thalamophora.* The *Arcellina*, however, differ from the *Foraminifera*, and agree with the *Amœba* in the blunt lobose character of the pseudopodia.

(Leidy, *Fresh-water Rhizopods of North America*, 1879; Carter, *Fresh-water Rhizopods*, Ann. and Mag. Nat. Hist., 1864; Hertwig and Lesser, *Ueber Rhizopoden und denselben nahe stehende Organismen*, Archiv f. Mikr. Anat., 1874; Frantz Eilhard Schultze, *Rhizopoden-Studien*, Archiv f. Mikr. Anat., 1875.)

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[1] The Sponges are here removed from the *Rhizopoda*, and are considered as an independent class of the *Protozoa.*

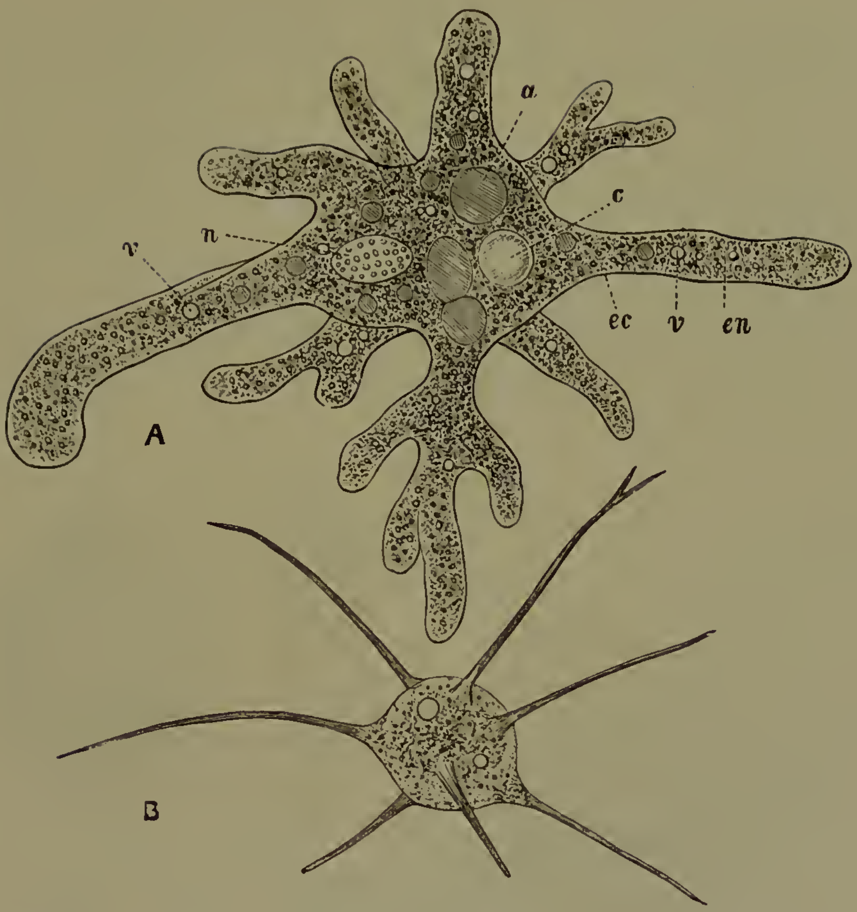

Fig. 3.—A, *Amœba proteus*, with the pseudopodia protruded, enlarged 200 diameters (after Leidy): *n*, Nucleus; *c*, Contractile vesicle; *v*, One of the larger food-vacuoles; *en*, The granular endosarc; *ec*, The transparent ectosarc; *a*, A cell of an Alga taken in as food (other cells of the same Alga are obliquely shaded). B, *Amœba radiosa*, enlarged 500 diameters (after Leidy). The body shows two large vacuoles, but no nucleus or contractile vesicle. The long and delicate pseudopodia are protruded.

ORDER III.—FORAMINIFERA, D'Orb. (RETICULARIA, Carp.)

Sub-ord. 1. Imperforata.

Fam. *a.* Gromidæ.—*Gromia, Microgromia.*
Fam. *b.* Miliolidæ.—*Miliola, Nubecularia, Peneroplis, Orbitolites.*
Fam. *c.* Astrorhizidæ.—*Astrorhiza, Saccammina.*
Fam. *d.* Lituolidæ.—*Lituola, Endothyra, Trochammina.*
Fam. *e.* *Parkeridæ.—*Parkeria, Loftusia.*

Sub-ord. 2. Perforata.

Fam. *a.* Textularidæ.—*Textularia, Bulimina, Cassidulina.*

Fam. *b.* Chilostomellidæ.—*Chilostomella.*

Fam. *c.* Lagenidæ.—*Lagena, Nodosaria, Marginulina, Cristellaria.*

Fam. *d.* Globigerinidæ—*Globigerina.*

Fam. *e.* Rotalidæ.—*Rotalia, Discorbina, Pulvinulina.*

Fam. *f.* Nummulinidæ.—*Nummulites,* **Fusulina, Orbitoides.*

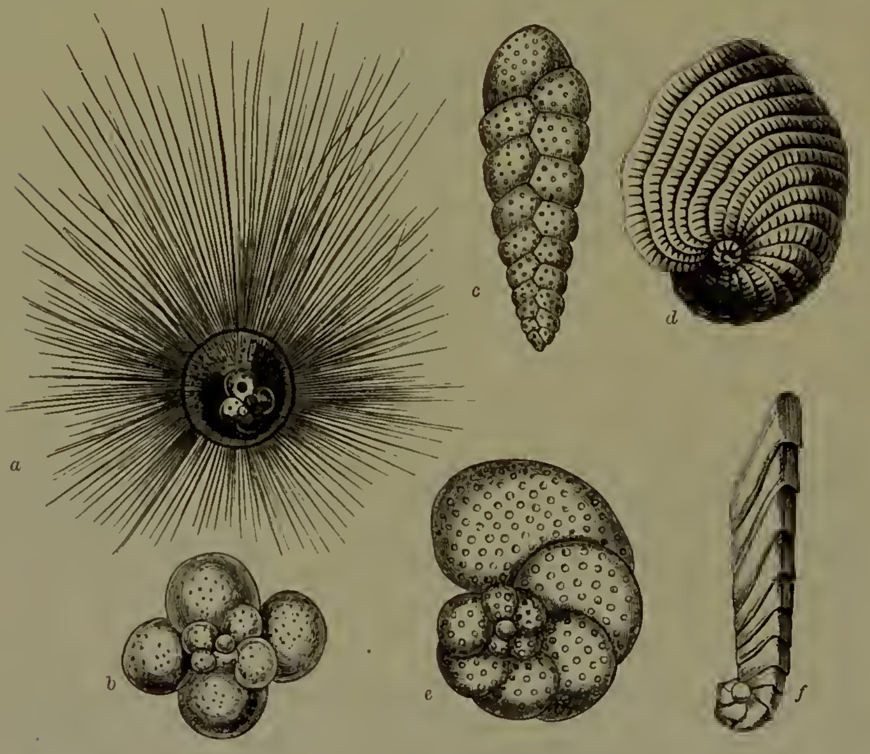

Fig. 4.—Shells of *Foraminifera*. *a*, *Orbulina universa*, in its perfect condition, showing the tubular spines which radiate from the surface of the shell; *b*, *Globigerina bulloides*, in its ordinary condition, the thin hollow spines which are attached to the shell when perfect having been broken off; *c*, *Textularia variabilis; d*, *Peneroplis planatus; e*, *Rotalia concamerata; f*, *Cristellaria subarcuatula.* (Fig. *a* is after Wyville Thomson; the others are after Williamson. All the figures are greatly enlarged.)

The above classification, except in the retention of the sub-orders *Imperforata* and *Perforata*, is that adopted by Mr H. B. Brady. It is true that the section of the *Imperforata* includes various forms in which the shell is known to be pierced to a larger or smaller extent with pseudopodial apertures, so that this division is not a strictly natural one ; but the majority of forms included under this title have truly an imperforate shell, and the name is one so long current and so widely used that it seems unadvisable to entirely discard it.

(W. B. Carpenter, Parker, and Rupert Jones, *Introduction to the Study of the Foraminifera*, 1862 ; Max Schultze, *Ueber den Organismus der Polythalamien*, 1854 ; H. B. Brady, *Reticularian Rhizopoda of the Challenger Expedition*, Quart. Journ. Micro. Sci., 1879-81 ; Von Reuss, *Entwurf einer systematischen Zusammenstellung der Foraminiferen*, Sitzungsb. K. Akad. Wiss. Wien, 1861 ; Hertwig, *Bemerkungen über die Organisation und systematische Stellung der Foraminiferen*, Jenaische Zeitschr. f. Naturwiss., 1876.)

ORDER IV.—RADIOLARIA.

Sub-ord. 1. Cytophora.

Fam. *a.* Acanthometrina.—*Acanthometra*, *Xiphaeantha* (fig. 5).

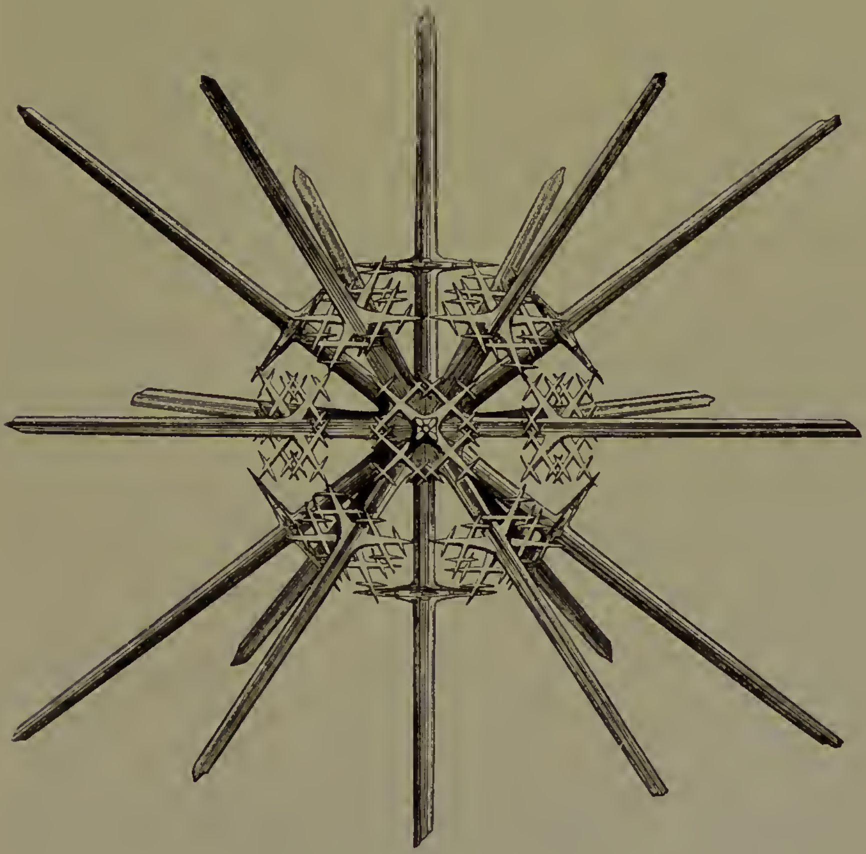

Fig. 5.—The skeleton of *Xiphacantha*, one of the *Acanthometrina*, greatly magnified. (After Sir Wyville Thomson.)

Fam. *b.* Polycystina.—*Podocyrtis, Dictyocha, Lychnocanium.*

Fam. *c.* Collozoa.—*Collozoum, Sphærozoum.*

Fam. *d.* Thalassicollida.—*Thalassicolla, Thalassolampe.*

Sub-ord. 2. Heliozoa.—*Actinosphærium, Heterophrys.*

It is still a matter of opinion whether the *Heliozoa* should be regarded as a division of the *Radiolaria*, or as a distinct order of Rhizopods. The chief differences which separate the *Heliozoa* from the typical Radiolarians are, that the former possess no central membranous capsule and no gelatinous investment, both these structures being, as a rule, present in the latter; but in other respects there is a close general likeness between the two.

(Hæckel, *Die Radiolarien*, 1862; Schneider, *Zur Kenntniss der Radiolarien*, Zeitschr. f. Wiss. Zool., 1871; Greeff, *Ueber Radiolarien, &c., des süssen Wassers*, Archiv für Mikr. Anat., 1869; Mivart, *Recent Researches on the Radiolaria*, Journ. Linn. Soc., 1878; Archer, *Résumé of Recent Contributions to our Knowledge of Freshwater Rhizopods*, Quart. Journ. Micro. Sci., 1876, 1877; Huxley, *On Thalassicolla*, Ann. Nat. Hist., 1851).

CLASS III.—INFUSORIA.

ORDER I.—FLAGELLATA.—*Monas, Cercomonas, Monosiga* (fig. 6, E), *Codosiga, Euglena, Peridinium, Ceratium* (fig. 6, D).

ORDER II.—SUCTORIA (Tentaculifera, Sav. Kent).—*Podophrya, Acineta.*

ORDER III.—CILIATA.

Sub-ord. 1. Holotricha.—*Paramœcium, Enchelys, Colpoda, Amphileptus* (fig. 6, C).

Sub-ord. 2. Heterotricha.—*Bursaria* (fig. 6, A), *Stentor, Codonella, Nyctotherus* (fig. 6, B).

Sub-ord. 3. Peritricha.—*Trichoderia, Vorticella, Epistylis.*

Sub-ord. 4. Hypotricha.—*Aspidisca, Euplotes, Chilodon.*

There is much ground for separating the so-called Suctorial and Flagellate *Infusoria* as two distinct and independent *classes* of the *Protozoa*. The latter, in particular, have very close affinities with the Sponges, though they are essentially unicellular organisms.

(Saville Kent, *Manual of the Infusoria*, 1880-81; Stein, *Der Organismus der Infusionsthiere*, 1859-67; Claparède et Lachmann, *Études sur les Infusoires et les Rhizopodes*, 1858-61; Allman, *Recent Progress in our Knowledge of the Infusoria*, Journ. Linn. Soc., 1875; Ehrenberg, *Die Infusionsthierchen als volkommene Organismen*, 1838.)

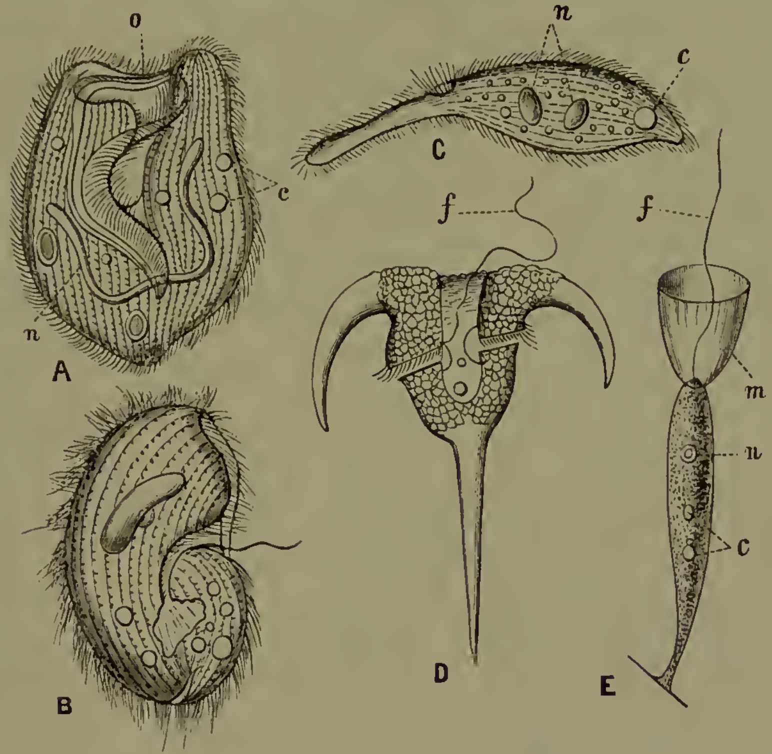

Fig. 6.—Ciliated and Flagellate Infusoria. A, *Bursaria truncatella*, enlarged 50 times. B, *Nyctotherus cordiformis*, enlarged 150 times. C, *Amphileptus anser*, enlarged 120 times. D, *Ceratium tripos*, enlarged 250 times, with its carapace and single flagellum. E, *Monosiga angustata*, enlarged 2500 times: *n*, Nucleus; *c*, Contractile vesicle; *f*, Flagellum; *m*, Membranous collar surrounding the base of the flagellum. (After, or copied from, Saville Kent.)

CLASS IV.—PORIFERA (SPONGIDA).

Order I.—Myxospongiæ.

Sub-ord. Halisarcidæ.—*Halisarca.*

Order II.—Ceratosa (Ceratospongiæ).

Sub-ord. 1. Gumminida.—*Chondrilla, Corticium, Osculina.*
Sub-ord. 2. Ceratina.—*Luffaria, Aplysina.*
Sub-ord. 3. Psammonemata.—*Euspongia, Dysidea.*
Sub-ord. 4. Rhaphidonemata.—*Chalina.*

Sub-ord. 5. Echinonemata.—*Axinella, Acanthella.*

Sub-ord. 6. Holorhaphidota. — *Halichondria, Isodictya, Reniera, Hymeniacidon, Cliona, Geodia, Tethya, Spongilla.*

ORDER III.—SILICEA (Silicispongiæ).

Sub-ord. 1. Lithistidæ.—*Discodermia, MacAndrewia, Corallistes, *Siphonia, *Aulocopium.*

Sub-ord. 2. Hexactinellidæ.—*Euplectella, Holtenia* (fig. 7), *Hyalonema, Dactylocalyx, * Ventriculites.*

ORDER IV.—CALCAREA (Calcispongiæ).—*Grantia, Leucosolenia.*

The most unnatural point in the above classification is the union under the head of "Ceratose Sponges" of types like *Euspongia*, in which spicules are not developed, with other types in which the horny skeleton is accompanied by siliceous spicules, or may be even replaced by the latter. A more natural classification probably is that adopted by Zittel, in accordance with which the Sponges are divided into the following orders :—

ORDER I.—MYXOSPONGIÆ.—*Halisarca.*

ORDER II.—CERATOSPONGIÆ.—*Euspongia* (Sponges of commerce).

ORDER III.—MONACTINELLIDÆ.—*Halichondria.*

ORDER IV.—TETRACTINELLIDÆ.—*Geodia, Tethya.*

ORDER V.—LITHISTIDÆ.—*Discodermia.*

ORDER VI.—HEXACTINELLIDÆ.—*Holtenia.*

ORDER VII.—CALCISPONGIÆ.—*Grantia.*

The systematic position of the Sponges has been a matter of much controversy among naturalists. Their animal nature is now universally admitted, and there is also no substantial difference of opinion as to the broad outlines of their anatomical structure. In all known forms of the Sponges, the organism consists of an aggregate of protoplasmic bodies (the "sponge-particles" or "sarcoids"), which differ in their characters in different parts of the Sponge, or at different periods of its life, but which are probably all fundamentally the same. Some of the sponge-particles precisely and in every respect resemble *Flagellate Infusoria*,

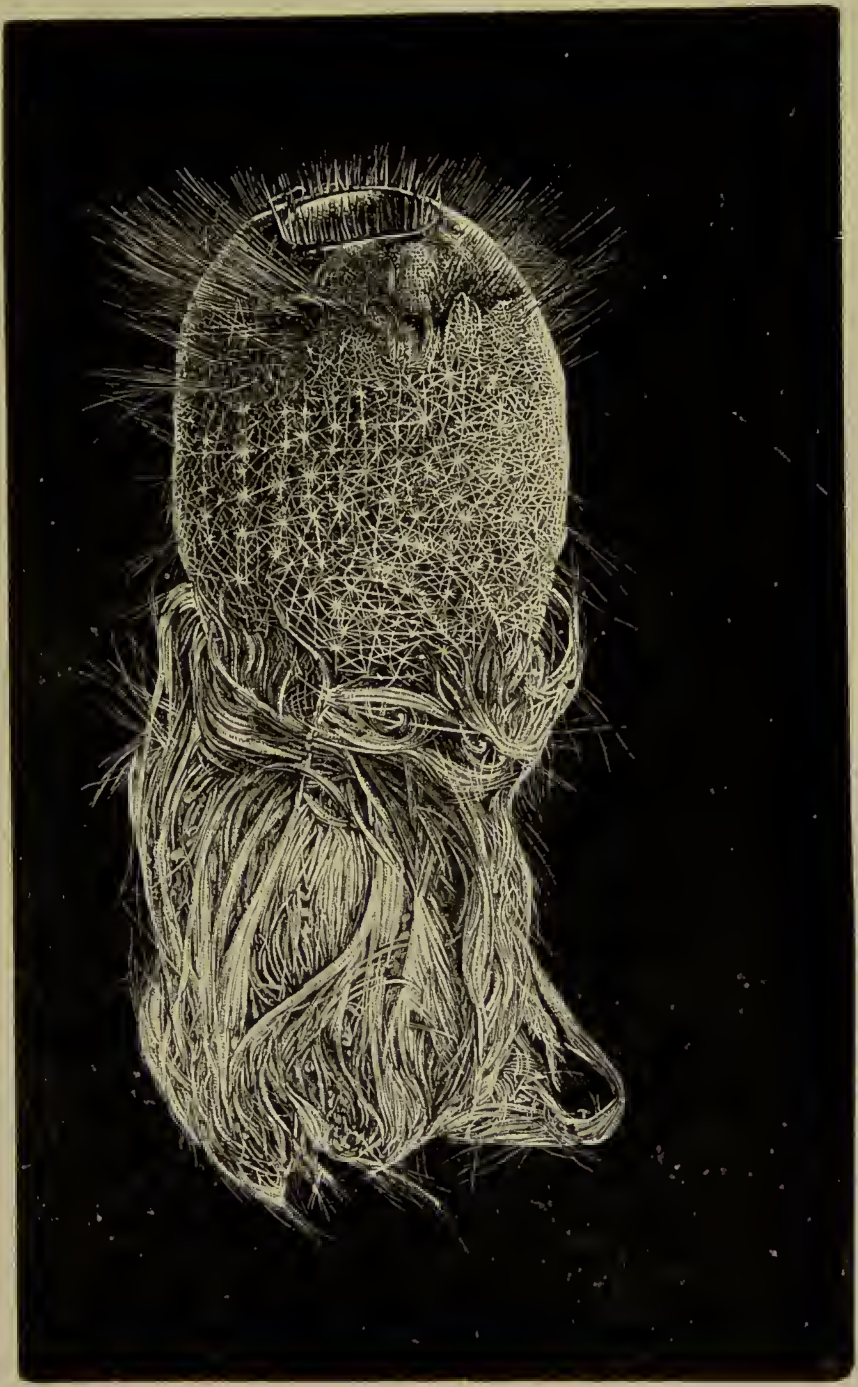

Fig. 7.—*Holtenia Carpenteri*, a siliceous Sponge belonging to the group of the *Hexactinellidæ*. (After Sir Wyville Thomson.)

while others present an equally close resemblance to *Amœbæ;* and others have more or less completely coalesced to form a gelatinous or mucilaginous common matrix or "cytoblastema." This protoplasmic aggregate may or may not be supported by a skeleton of diverse composition and structure ; but it is always so disposed as to be traversed by a series of canals, which convey water in and out of the organism, and are connected with respiration and the procuring of food. These canals commence on the surface by numerous small "inhalant" apertures or "pores," which admit the external water, and they ramify through the substance of the Sponge. They ultimately open on the surface by a series of "exhalant" canals, which converge to a common aperture of large size—the so-called "osculum," which serves as an outlet for the water-currents. The entire system of water-canals may be lined with flagellate sponge-particles, similar in structure to Flagellate Infusoria ; or they are, more commonly, dilated at intervals into globular chambers, which are lined by these flagellate sarcoids (fig. 8), the vibrations of the flagella of these serving to keep up a circulation of water through the body of the Sponge. Lastly, a Sponge may consist of one excretory opening or "osculum," together with the "pores" belonging to this ; or it may consist of a larger or smaller number of such oscula, each with its proper complement of "pores."

Until within the last few years, Sponges have been generally regarded by naturalists as belonging to the *Protozoa*, and as either referable to the *Rhizopoda*, or as constituting a separate division of *Protozoa.* Recently, however, the view has been put forward by Professor Hæckel, and has been largely accepted by zoologists, that the Sponges are properly *Metazoa*, and that they are truly allied to the Corals, and therefore properly referable to the *Cœlenterata.* As a modification of this view, the Sponges are regarded as constituting a group of *Metazoa* intermediate between the Cœlenterates and the *Protozoa.* If Hæckel's view as to the affinities of the Sponges be received, it is necessary to accept the view which this distinguished writer advocates with regard to the *development* of the Sponges, —namely, that the ovum of the *Spongida* undergoes a regular process of "segmentation," consequent on fecundation by a spermatozoön, and that it becomes converted into an embryo ("gastrula") composed of an outer and inner cellular layer, enclosing a central cavity. On the other hand, a large amount of evidence has been brought forward by various observers, and notably by Mr Saville Kent, which would go to show that true sexual reproduction, by means of proper "ova" and "spermatozoa," is of very doubtful occurrence among the Sponges ; and that it is very questionable, therefore, if there is truly any such phenomenon in their development as the "segmentation" of an ovular cell. The supposed two-layered "gastrula" of the Sponges would rather appear to be really an asexually produced "swarm-gemmule," composed partly or wholly of flagellate zoöids or monads, entirely similar in their structure to the Flagellate Infusoria, and resulting from the segmentation of a single "sponge-particle" of the adult Sponge, without previous impregnation by a spermatozoid. Upon this view, therefore, the development of the Sponge becomes capable of being strictly paralleled by that of several groups of undoubted *Protozoa*, but acquires a significance entirely different from that which must be ascribed to the development of the *Metazoa*.

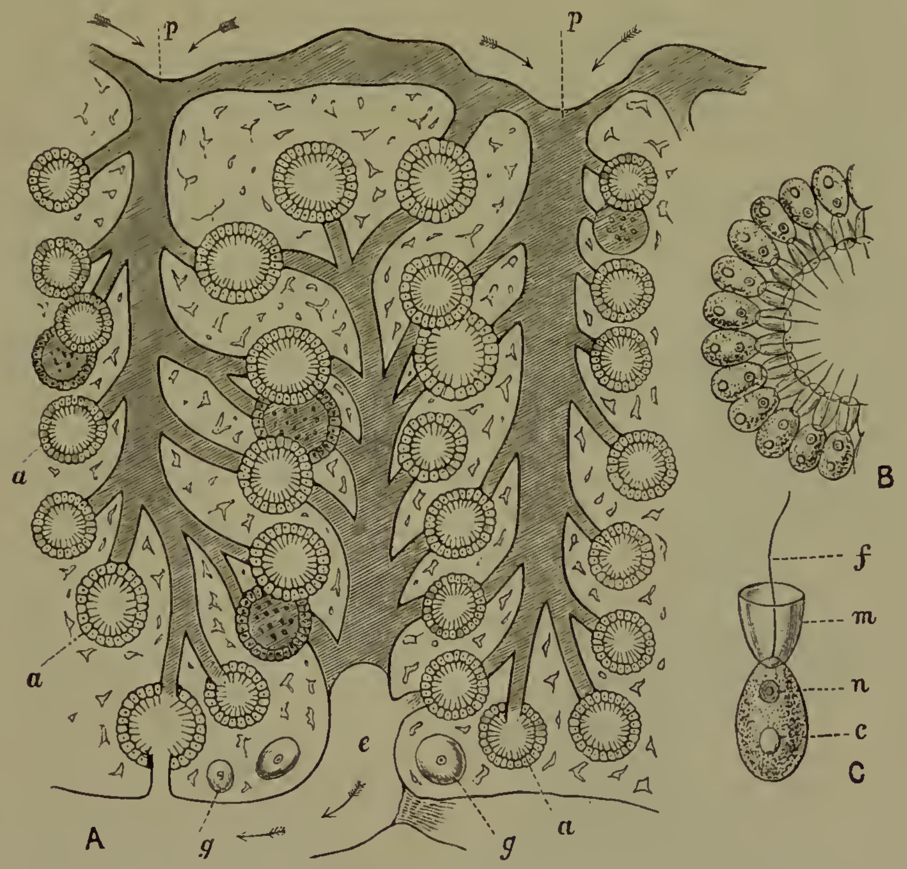

Fig. 8.—Structure of Spongida. A, Vertical section of the outer layer of *Halisarca lobularis*, a Sponge in which the skeleton is wanting, enlarged 75 times (after F. E. Schultze): *p p*, "Pores," or openings of afferent canals by which water is conducted to the ciliated chambers or "ampullaceous sacs" (*a a*); *e*, Commencement of a larger efferent canal, conducting from the ampullaceous sacs to the deeper canals, by which the water is finally carried off to be expelled from the "oscula;" *g g*, Young stages of the reproductive bodies or spores. B, Part of a single ampullaceous sac of the same Sponge, transversely divided, and enlarged 800 diameters (after Saville Kent), showing the flagellate monads or "sponge-particles," with their inwardly directed flagella. C, A single flagellate monad of the same, still further enlarged: *f*, Flagellum; *m*, Collar round the base of the flagellum; *n*, Nucleus; *c*, Contractile vesicle.

Accepting, then, in the meanwhile, the last-mentioned views as to the real character and import of the development of the *Spongida*, it seems inevitable that these organisms must, with our present knowledge, be included among the *Protozoa*. This conclusion, moreover, is the one which is clearly deducible from a study of the structure of the adult organism, since it is certain that there exists an almost absolute identity of structure between the flagellate zoöids of the Sponges and the Flagellate Infusoria,—the reference of the latter to the *Protozoa* having never been called in question. It may be added, that even if it were proved that the Sponges were properly referable to the *Metazoa*, it would still require very much more evidence than has yet been brought forward, before their relationships with the *Cœlenterata* could be reasonably admitted. Upon the whole, therefore, it is probably best—if only as a provisional arrangement—to regard the Sponges as a special division of the *Protozoa*, closely allied to the *Infusoria*, but with sufficient peculiarities of their own to entitle them to a special place and a special name (*Porifera*).

(Oscar Schmidt, *Die Spongien des Adriatischen Meeres*, 1862, 1866; *Grundzüge einer Spongien-fauna des Atlantischen Gebietes*, 1870; and *Spongien des Meerbusen von Mexico*, 1880. Carter, *Notes introductory to the Study and Classification of the Spongida*, Ann. and Mag. Nat. Hist., 1875. Bowerbank, *A Monograph of the British Spongidæ*, 1866, 1874. Hæckel, *Die Kalkschwämme*, 1872. Johnston, *A History of the British Sponges and Lithophytes*, 1842. Saville Kent, *Manual of the Infusoria*, 1880-81. Zittel, *Beiträge zur Systematik fossiler Spongien*, Neues Jahrb. für Min., Geol., und Paleont., 1877-78, and Handbuch der Paleontologie, 1879.)

SUB-KINGDOM (TYPE) II.—CŒLENTERATA.

Radially symmetrical animals, in which the mouth opens into a simple or variously divided space, which represents the alimentary tract, and which may or may not be divided into two portions,—one specially connected with digestion, and the other corresponding with the body-cavity of the higher animals. Body-wall composed of two fundamental layers ("ectoderm" and "endoderm"). Nervous system sometimes specialised, sometimes diffused, but no vascular system developed. Reproductive organs invariably present at some period or another of life, though asexual reproduction is very general.

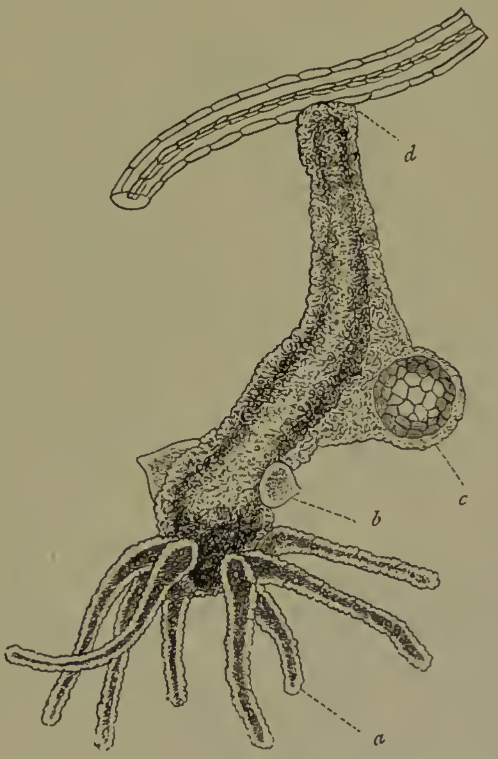

Fig. 9.—The Green Fresh-water Polype (*Hydra viridis*), suspended head-downwards from a piece of a stem of an aquatic plant, enlarged. *a*, One of the tentacles; *b*, Testis or spermarium, with spermatozoa in its interior; *c*, A single large ovum, protruding from the side of the body; *d*, Disc of attachment ("hydrorhiza").

CLASS I.—HYDROZOA.

Sub-class I.—Hydroida (Hydroid Zoophytes).

Order I.—Hydrida.—*Hydra* (Fresh-water Polype, fig. 9).

(Kleinenberg, *Hydra, eine anatomisch-entwickelungsgeschichtliche Untersuchung*, 1872.)

ORDER II.—CORYNIDA.—*Coryne, Tubularia, Clava, Bougainvillea* (fig. 10), *Eudendrium, Hydractinia.*

(Allman, *Monograph of the Gymnoblastic or Tubularian Hydroids*, Ray Society, 1871 ; Hincks, *British Hydroid Zoophytes*, 1872 ; Louis Agassiz, *Contributions to the Natural History of the United States*, vols. iii. and iv., 1860-62.)

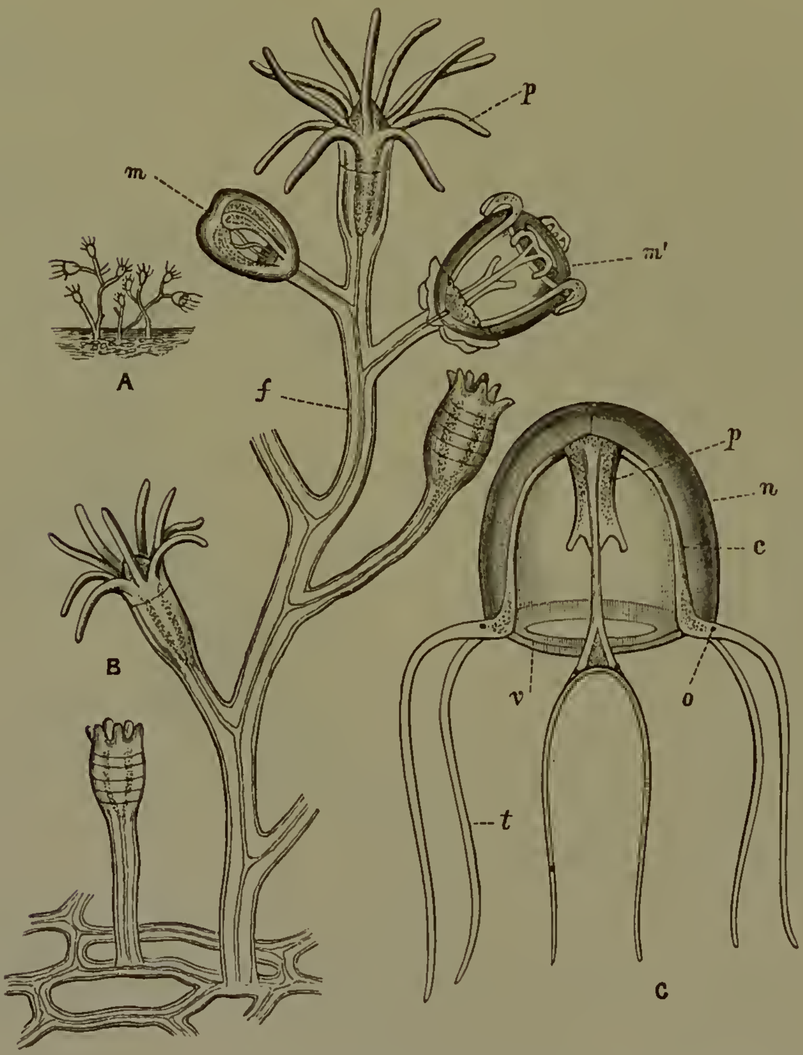

Fig. 10.—Corynida. A, Part of the colony of *Bougainvillea muscus*, of the natural size. B, Part of the same enlarged: *p*, A polypite fully expanded; *m*, An incompletely developed medusiform bud; *m'*, A more completely developed medusiform bud; *f*, Cœnosarc with its investing periderm and central canal. C, A free medusiform gonophore of the same; *n*, Gonocalyx; *p*, Manubrium; *c*, One of the radiating gastro-vascular canals; *o*, Ocellus; *v*, Velum; *t*, Tentacle. (After Allman.)

ORDER III.—SERTULARIDA.—*Sertularia* (Sea-fir), *Diphasia* (fig. 11), *Plumularia*, *Antennularia*.

ORDER IV.—CAMPANULARIDA.—*Campanularia*, *Obelia*, *Clytia*, *Lafoëa*, *Thaumantias*, *Æquorea*.

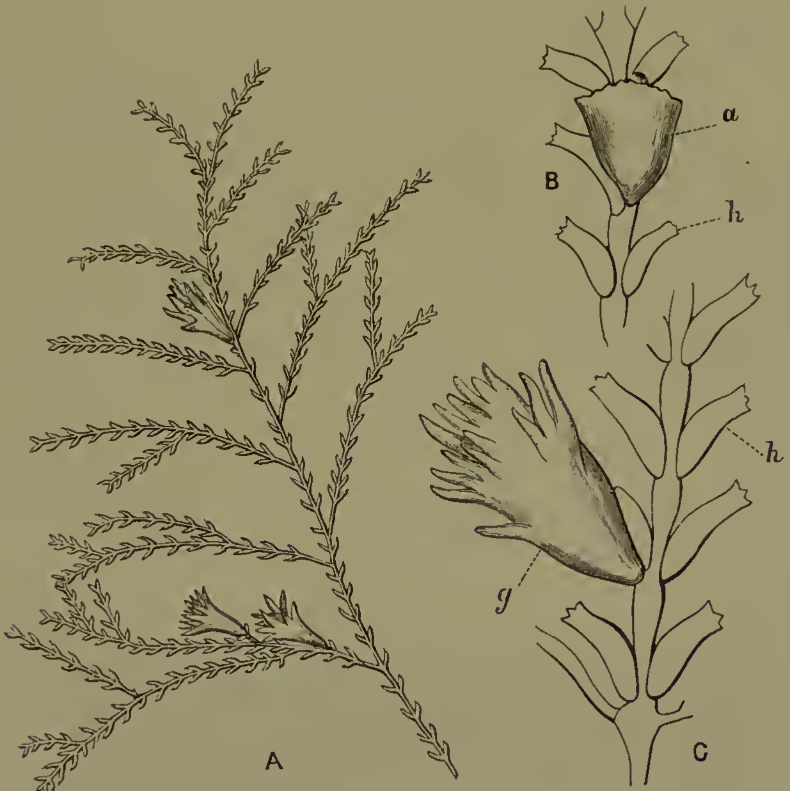

Fig. 11.—Sertularida. A, Portion of the colony of *Diphasia tamarisca*, of the natural size, showing hydrothecæ and female ovarian capsules (gonangia). B and C, Portions of different branches of the same, enlarged: *h*, Hydrothecæ; *a*, Male gonangium; *g*, Female gonangium. (After Hincks.)

ORDER V.—THECOMEDUSÆ.—*Stephanoscyphus*.

ORDER VI.—HYDROMEDUSIDÆ (Medusidæ).—*Trachynema* (fig. 12), *Ægina*.

(Hæckel, *Das System der Medusen*, Jena, 1879).

(Huxley, *Monograph of the Oceanic Hydrozoa*, Ray Society, 1859; Kölliker, *Die Siphonophoren oder Schwimm-polypen von Messina*, 1853; Gegenbaur, *Beobachtungen über Schwimm-polypen*, Zeitschr. für Wiss. Zool., 1854.)

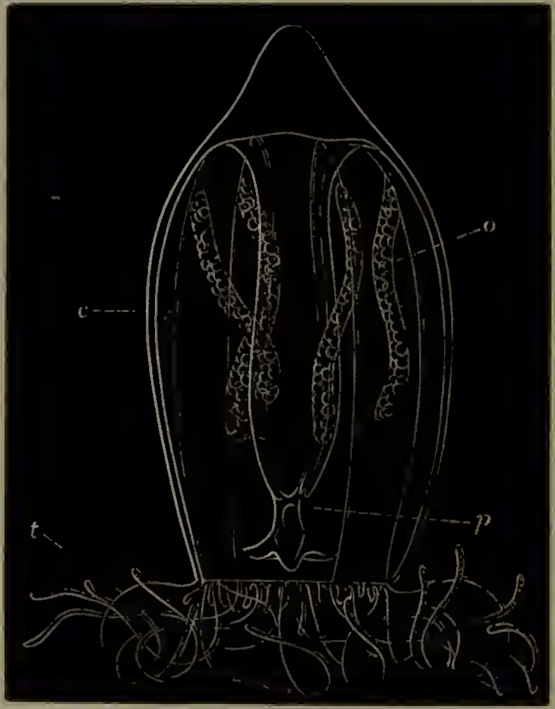

Fig. 12.—*Trachynema digitale*, a naked-eyed Medusa, female, enlarged. (After A. Agassiz.) *p*, Manubrium or central polypite; *t*, One of the tentacles; *c*, One of the gastro-vascular canals; *o*, One of the ovaries.

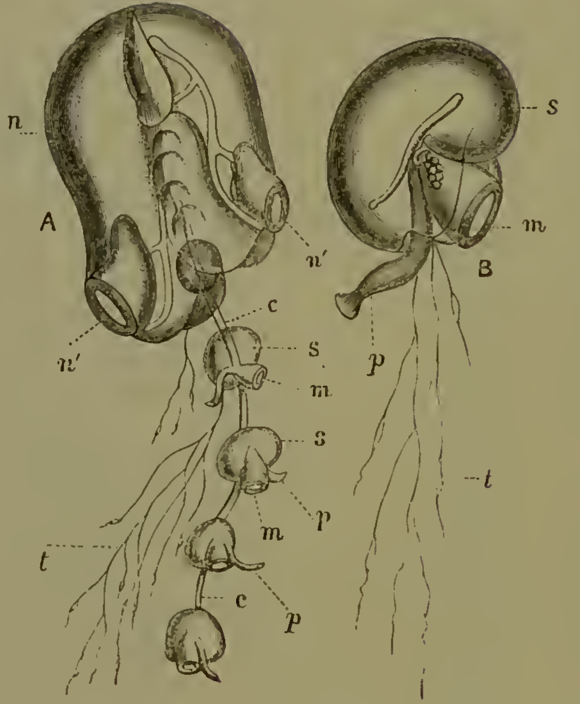

Fig. 13.—Calycophoridæ. A, Upper portion of the colony of *Praya maxima*, of the natural size: *n*, The proximal nectocalyces; *n′ n′*, Mouths of the same; *c c*, Cœnosarc, carrying polypites (*p p*) at intervals, along with their swimming-bells (*s s*), the openings of these being indicated by the letters *m m*; *t*, tentacles. B, A single polypite of the same (*p*), separated from the cœnosarc, and enlarged, with its swimming-bell (*s*), the opening of the bell (*m*), and the tentacles (*t*). (After Gegenbaur.)

Sub-class II.—Siphonophora.

Order I. — Calycophoridæ. — *Diphyes*, *Praya* (fig. 13), *Vogtia*.

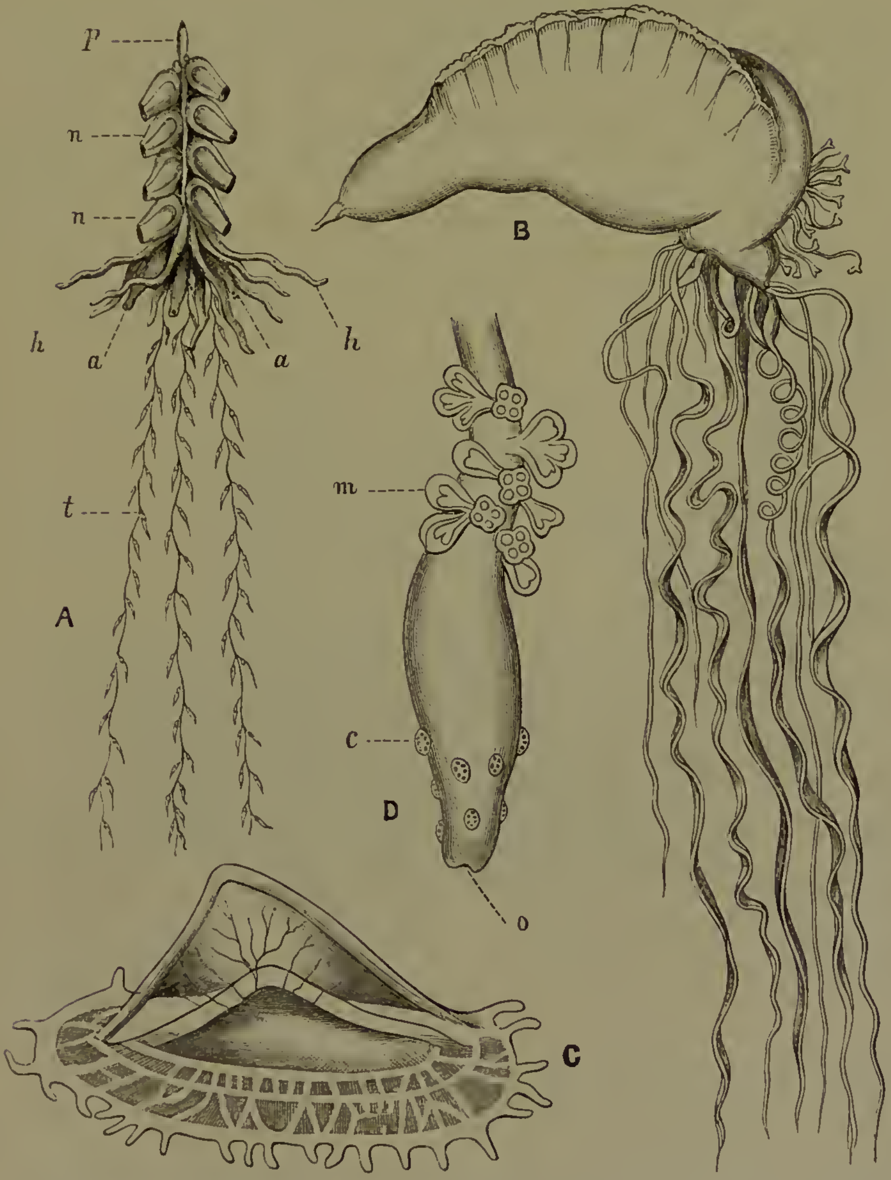

Fig. 14.—Physophoridæ. A, *Physophora Philippi*: *p*, The pneumatophore; *n n*, The nectocalyces; *h h*, Hydrocysts; *a a*, Polypites; *t*, Tentacles. B, *Physalia pelagica*. C, *Velella spirans*. D, One of the smaller polypites (phyogemmaria) of the same, showing (*o*) the mouth, (*c*) elevations studded with thread-cells, and (*m*) medusoid buds.

ORDER II.—PHYSOPHORIDÆ.—*Physophora* (fig. 14), *Physalia* (Portuguese Man-of-war, fig. 14), *Velella* (fig. 14 C), *Porpita*, *Agalma*, *Stephanomia*.

SUB-CLASS III.—LUCERNARIDA.

SECTION I.—CALYCOZOA (Podactinaria).

Order.—LUCERNARIADÆ.—*Lucernaria*, *Carduella*, *Depastrum*.

SECTION II.—ACRASPEDA.

Order I.—MONOSTOMATA.

Fam. 1. Pelagidæ.—*Pelagia*.
Fam. 2. Cyaneidæ.—*Cyanea*.
Fam. 3. Aureliidæ.—*Aurelia*.

Order II.—RHIZOSTOMATA.

Fam. 1. Rhizostomidæ.—*Rhizostoma* (fig. 15).
Fam. 2 Cepheidæ.—*Cephea*.
Fam. 3. Polyclonidæ.—*Polyclonia*.
Fam. 4. Cassiopeidæ.—*Cassiopeia*.
Fam. 5. Crambessidæ.—*Crambessa*.

(Huxley, *On the Anatomy and Affinities of the Family of the Medusidæ*, Phil. Trans., 1849; Brandt, *Ueber Rhizostoma Cuvieri*, Mem. Acad. St Petersbourg, 1870.)

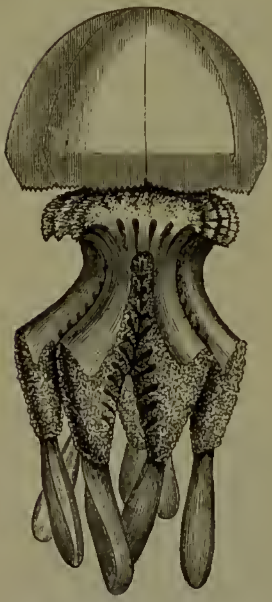

Fig. 15.—Generative zoöid of *Rhizostoma pulmo*, reduced in size. (After Gosse.)

SUB-CLASS IV.—*GRAPTOLITIDÆ.

ORDER I.—MONOPRIONIDÆ. — *Monograptus*, *Didymograptus*, *Tetragraptus*, *Dichograptus*.

ORDER II.—DIPRIONIDÆ.—*Diplograptus*, *Climacograptus*.

ORDER III.—TETRAPRIONIDÆ.—*Phyllograptus*.

ORDER IV.—RETIOLOIDEA.—*Retiolites*.

(Hall, *Graptolites of the Quebec Series*, 1865; Nicholson, *Monograph of the British Graptolitidæ*, 1872; Lapworth, *Notes on British Graptolites*, Geol. Mag., 1873.)

SUB-CLASS V.—HYDROCORALLINÆ.

Fam. 1. Milleporidæ.—*Millepora* (fig. 16).
Fam. 2. Stylasteridæ.—*Stylaster*, *Pliobothrus*, *Errina*, *Distichopora*.

(H. N. Moseley, *Report on certain Hydroid, Alcyonarian, and Madreporarian Corals*, Report of the Scientific Results of the Voyage of H.M.S. Challenger, 1881.)

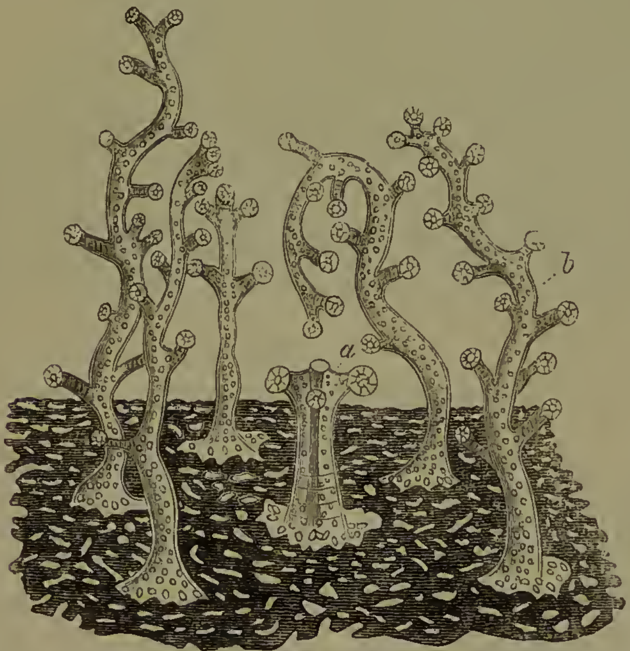

Fig. 16.—Enlarged view of a portion of the surface of a living colony of *Millepora nodosa*, showing the expanded zoöids of a single system. *a*, Central "gastrozoöid;" *b*, One of the mouthless "dactylozoöids." (After Moseley.)

CLASS II.—ACTINOZOA.

ORDER I.—ZOANTHARIA.

Sub-ord. 1. Zoantharia malacodermata.

Fam. *a*. Actinidæ (Sea-anemones).—*Actinia* (fig. 17), *Tealia*, *Sagartia*, *Minyas*.

Fam. *b.* Ilyanthidæ. — *Ilyanthus, Arachnactis, Edwardsia.*

Fam. *c.* Zoanthidæ.—*Zoanthus, Palythoa.*

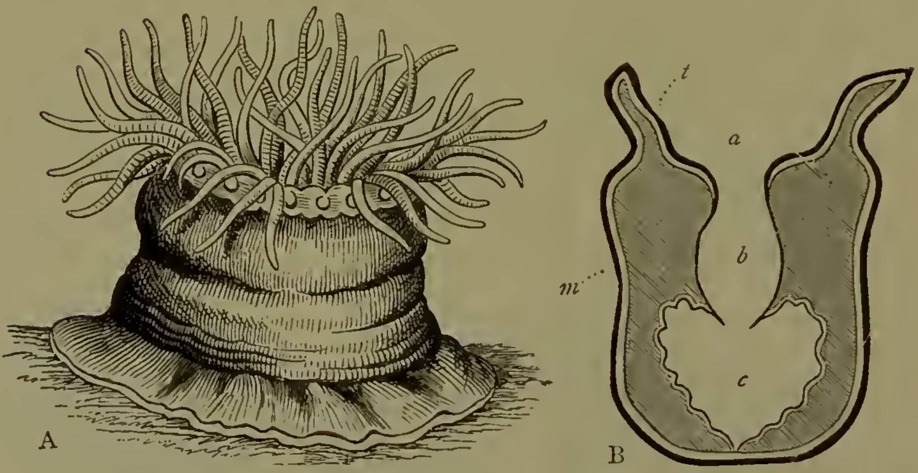

Fig. 17.—A, *Actinia mesembryanthemum*, one of the Sea-anemones (after Johnston). B, Section of the same, showing the mouth (*a*), the stomach (*b*), and the body-cavity (*c*); *t*, Tentacle; *m*, Face of a mesentery.

Sub-ord. 2. Zoantharia sclerobasica.

Fam. *a.* Antipathidæ.—*Antipathes.*

Sub-ord. 3. Zoantharia sclerodermata (Madreporaria).

Section A. Perforata.

Fam. *a.* Poritidæ.—*Porites, Alveopora.*

Fam. *b.* *Favositidæ.—*Favosites, Michelinia, Alveolites.*

Fam. *c.* *Syringoporidæ.—*Syringopora.*

Fam. *d.* Eupsammidæ.—*Balanophyllia, Dendrophyllia.*

Fam. *e.* Madreporidæ.—*Madrepora.*

Section B. Aporosa.

Fam. *a.* Fungidæ.—*Fungia.*

Fam. *b.* Pseudofungidæ.—*Merulina.*

Fam. *c.* Astræidæ.—*Astræa, Meandrina, Diploria.*

Fam. *d.* *Columnariadæ.—*Columnaria.*

Fam. *e.* Oculinidæ. — *Oculina, Lophohelia, Amphihelia.*

Fam. *f.* Pseudoturbinolidæ.—*Dasmia.*

Fam. *g.* Turbinolidæ.—*Turbinolia, Flabellum.*

(Oscar Hertwig and Richard Hertwig, *Die Actinien*, Jena, 1879; Gosse, *Actinologia Britannica*, 1860; Dana, *Report on Zoophytes*, 1849; Milne-Edwards and Haime, *Histoire Naturelle des Coralliaires*, 1857-60.)

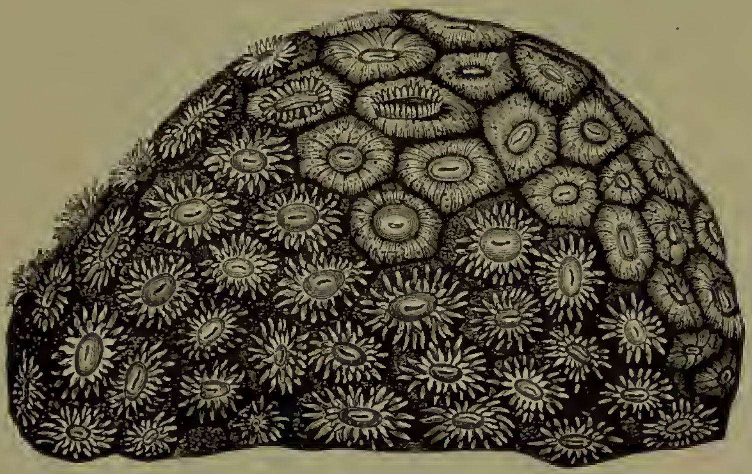

Fig. 18.— *Astræa pallida*, a compound sclerodermic Coral, in a living condition. (After Dana.)

ORDER II.—ALCYONARIA.

Fam. *a.* Alcyonidæ.—*Alcyonium* (Dead-men's Fingers), *Rhizoxenia.*

Fam. *b.* Tubiporidæ.—*Tubipora* (Organ-pipe Coral).

Fam. *c.* Pennatulidæ.— *Pennatula* (Sea-pen, fig. 20), *Virgularia* (Sea-rod), *Veretillum* (fig. 19), *Renilla, Pavonaria.*

Fam. *d.* Gorgonidæ.—*Gorgonia* (Sea-shrub), *Isis, Corallium* (Red Coral), *Rhipidogorgia* (Fan-coral, fig. 21), *Mopsea.*

Fam. *e.* Helioporidæ.—*Heliopora.*

Fam. *f.* *Halysitidæ.—*Halysites.*

Fam. *g.* *Tetradiidæ.—*Tetradium.*

Fam. *h.* *Thecidæ.—*Thecia.*

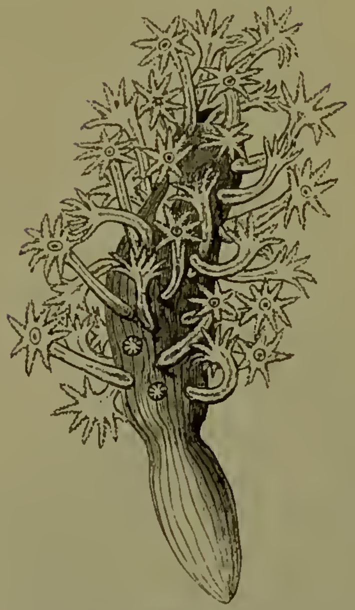

Fig. 19.—Colony of *Veretillum cynomorium*, of the natural size, with the polypes protruded.

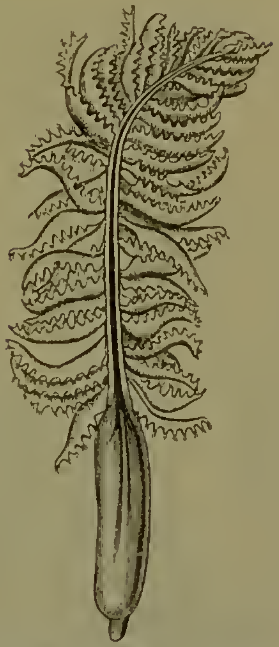

Fig. 20.—*Pennatula sulcata*, seen from the dorsal side. Slightly reduced, after Kölliker.

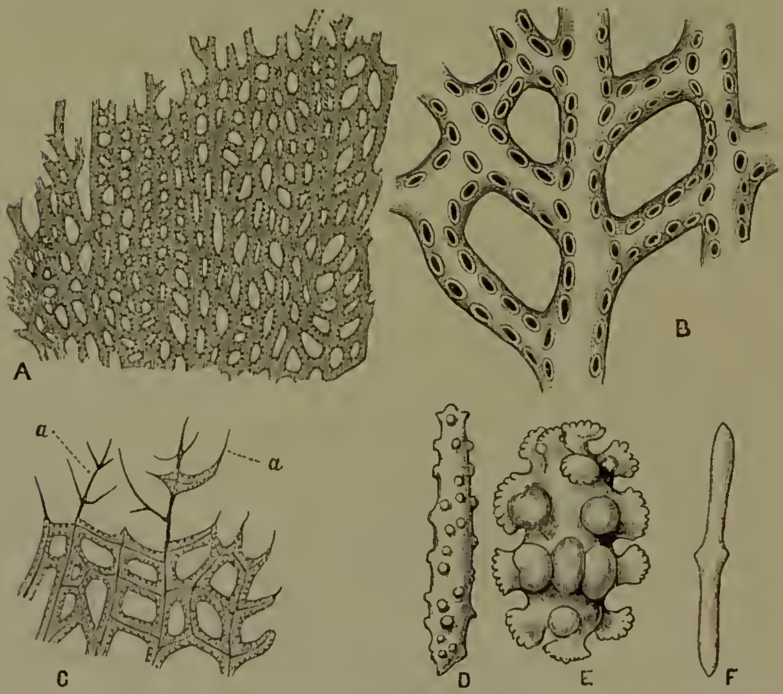

Fig. 21.—A, Fragment of the common Fan-coral (*Rhipidogorgia flabellum*), reduced about one-half. B, Portion of the same enlarged, showing the polype-cells. C, Branchlet of the same partly denuded of the soft parts, and showing the horny axis (*a*). D, E, and F, Flesh-spicules ("dermosclerites") of *Gorgonidæ*, greatly enlarged: D, of *Gorgonia radula*; E, of *Sclerogorgia suberosa*; F, of *Melithæa ochracea*. (After A. Agassiz and Kölliker.)

Fam. *i.* *Chætetidæ—*Chætetes.*
Fam. *j.* *Monticuliporidæ.—*Monticulipora.*
Fam. *k.* *Auloporidæ.—*Aulopora.*

(Kölliker, *Anatomisch-systematische Beschreibung der Alcyonarien*, 1870; Kölliker, *Report on the Pennatulida*, Report of the Scientific Results of the Voyage of H.M.S. Challenger, 1881; H. N. Moseley, *Report on certain Hydroid, Alcyonarian, and Madreporarian Corals*, ibid., 1881; Nicholson, *On the Structure and Affinities of the "Tabulate Corals" of the Palæozoic Period*, 1879.)

ORDER III.—*RUGOSA.

Fam. *a.* Stauridæ.—*Stauria* (fig. 22), *Holocystis.*
Fam. *b.* Cyathaxonidæ.—*Cyathaxonia.*
Fam. *c.* Cyathophyllidæ. — *Cyathophyllum, Heliophyllum, Zaphrentis.*
Fam. *d.* Cystiphyllidæ.—*Cystiphyllum, Goniophyllum.*

(Milne-Edwards and Haime, *Polypiers fossiles des terrains paléozoiques*, 1851.)

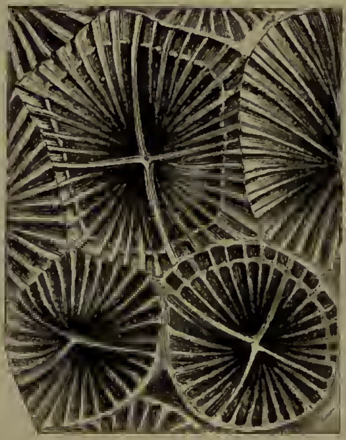

Fig. 22.—A few calices of *Stauria astræiformis*, enlarged, showing the four primary septa forming a four-branched cross. Upper Silurian. (After Milne-Edwards and Haime.)

ORDER IV.—CTENOPHORA.

Sub-ord. 1. Eurystomata.—*Beroë, Idyia.*
Sub-ord. 2. Saccatæ.—*Pleurobrachia, Hormiphora.*
Sub-ord. 3. Lobatæ.—*Bolina.*
Sub-ord. 4. Tæniatæ.—*Cestum* (Venus's Girdle, fig. 23).

(Gegenbaur, *Studien über Organisation und Systematik der Ctenophoren*, Archiv für Naturgeschichte, 1856; L. Agassiz, *Contributions to the Natural History of the United States of America*, vol. iii., 1860.)

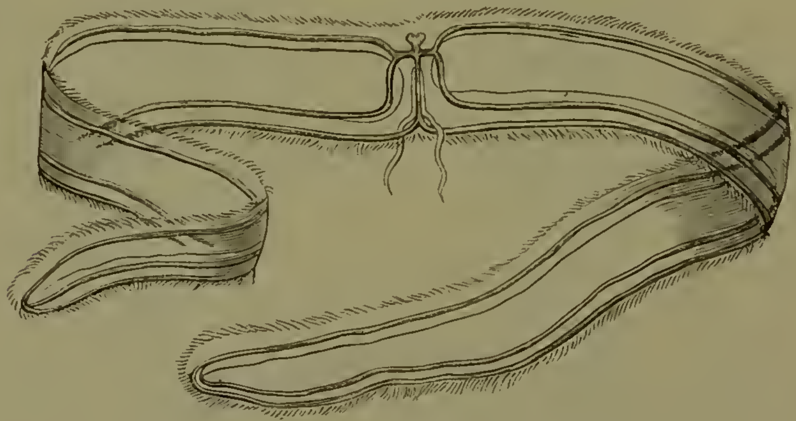

Fig. 23.—Ctenophora. *Cestum Veneris*, reduced in size.

SUB-KINGDOM (TYPE) III.—ECHINODERMATA.

Simple marine organisms, which are mostly bilaterally symmetrical when young, but which in the adult condition have this bilateral symmetry more or less extensively masked by a radial (usually pentamerous) arrangement of their parts. An alimentary canal, with or without a distinct anus, separate from the proper body-cavity. A system of water-vessels, often communicating directly with the exterior, and generally connected with protrusible tubes ("feet"), is present. The nervous system is radiate, consisting of an œsophageal ring and radiating branches. The integument is characteristically hardened by the deposition in it of carbonate of lime in the form of plates, granules, or spicules.

Order I.—Echinoidea (Sea-Urchins).

- Sub-ord. 1. Regularia (Desmosticha).
  - Fam. *a.* Cidaridæ.—*Cidaris, Poroeidaris.*
  - Fam. *b.* Arbaciadæ.—*Arbaeia, Cœlopleurus.*
  - Fam. *c.* Diadematidæ. — *Diadema, Aspidodiadema, Hemicidaris.*
  - Fam. *d.* Saleniadæ.—*Salenia.*
  - Fam. *e.* Temnopleuridæ.—*Temneehinus.*
  - Fam. *f.* Echinidæ.—*Echinus.*
  - Fam. *g.* Echinothuridæ. — *Asthenosoma, Phormosoma, Eehinothuria.*

- Sub-ord. 2. *Perischoechinidæ.
  - Fam. *a.* *Archæocidaridæ.—*Arehæocidaris.*
  - Fam. *b.* *Palæchinidæ.—*Palæchinus.*

Sub-ord. 3. Irregularia.

Fam. *a.* Echinoconidæ.—*Pygaster*, **Galerites.*

Fam. *b.* Clypeastridæ.—*Clypeaster*, *Echinocyamus*, *Fibularia.*

Fam. *c.* Scutellidæ. — *Mellita*, *Rotula*, *Echinarachnius*, **Scutella.*

Fam. *d.* Echinoneidæ.—*Echinoneus.*

Fam. *e.* Echinobrissidæ.—*Nucleolites.*

Fam. *f.* Echinolampadæ (Cassidulidæ).—*Echinolampas*, *Rhynchopygus.*

Fam. *g.* *Collyritidæ (Dysastridæ).—*Collyrites.*

Fam. *h.* *Ananchytidæ.—*Ananchytes.*

Fam. *i.* Spatangidæ.—*Spatangus*, *Amphidetus*, *Brissus*, **Micraster.*

(L. Agassiz, *Monographie d'Echinodermes vivans et fossiles*, 1838-42 ; A. Agassiz, *Revision of the Echini*, 1874 ; Lovén, *Études sur les Echinoïdes*, 1874 ; A. Agassiz, *Report on the Echinoidea*, Report of the Scientific Results of the Exploring Voyage of H.M.S. Challenger, 1881.)

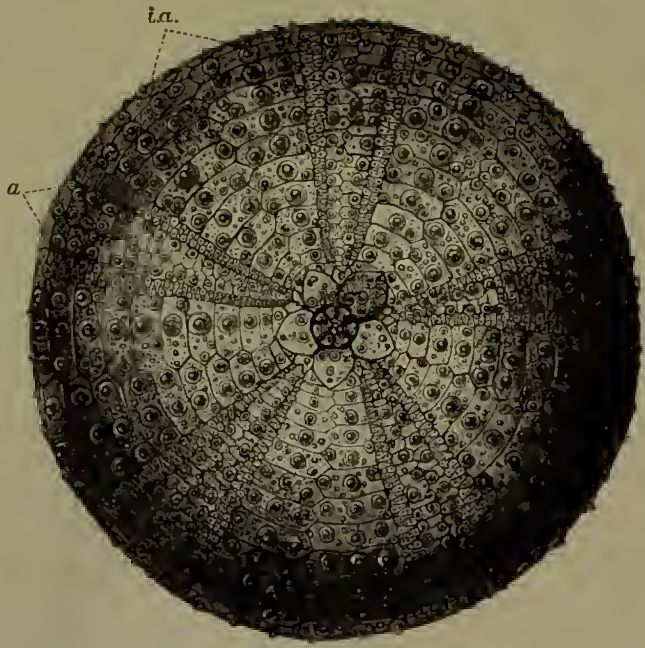

Fig. 24.—Echinoidea. Test of *Echinus esculentus*, viewed from above. *a*, One of the ambulacral areas ; *ia*, One of the interambulacral areas.

ORDER II.—ASTEROIDEA (Star-fishes).

Fam. *a.* Asteracanthiidæ.—*Uraster* (*Asteracanthion*), *Heliaster.*

Fam. *b.* Solasteridæ.—*Solaster, Cribella* (*Echinaster*).

Fam. *c.* Linckiadæ.—*Linckia.*

Fam. *d.* Asterinidæ.—*Asterina, Palmipes, Goniaster, Culcita.*

Fam. *e.* Astropectinidæ.—*Astropecten* (*Asterias*), *Ctenodiscus, Luidia, Archaster.*

Fam. *f.* Pterasteridæ.—*Pteraster, Hymenaster.*

Fam. *g.* Brisingidæ.—*Brisinga.*

Fam. *h.* *Palæasteridæ.—*Palæaster.*

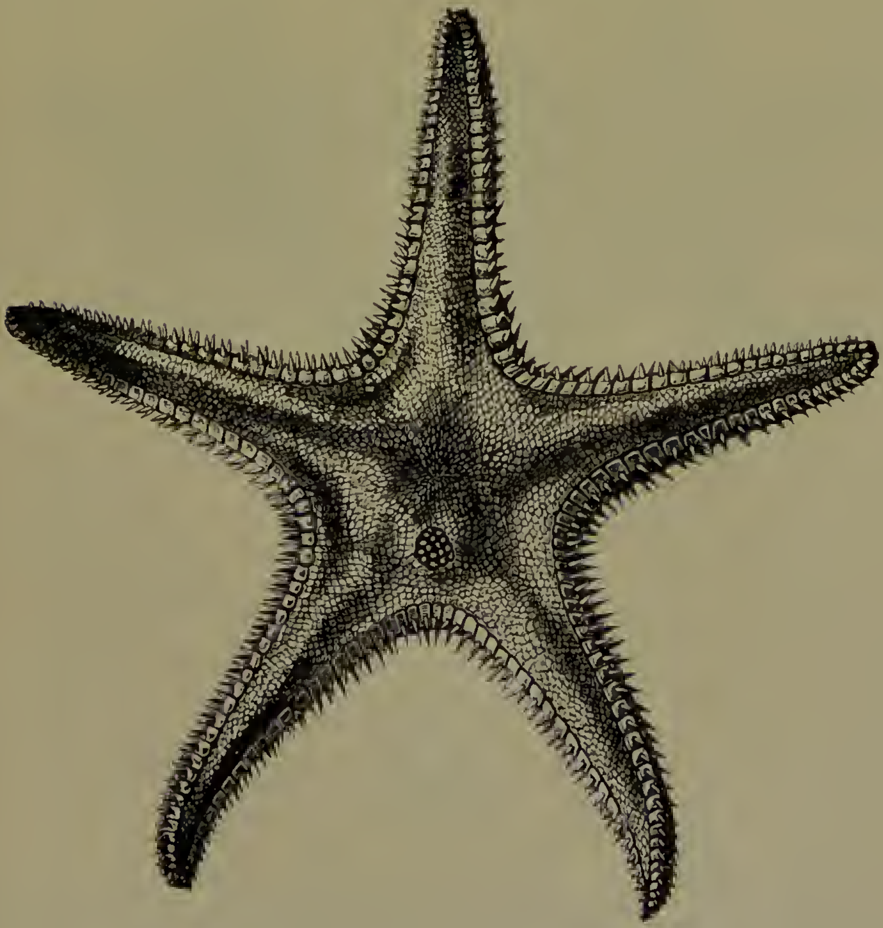

Fig. 25.—Asteroidea. *Archaster bifrons*, viewed from the dorsal aspect. Three-fourths of the natural size. (After Sir Wyville Thomson.)

(Müller and Troschel, *System der Asteriden*, 1842 ; A. Agassiz, *North American Star-fishes*, Cambridge, Mass., 1877 ; E. Perrier, *Révision de la Collection de Stellérides du Museum d'Histoire naturelle de Paris*, Archiv de Zool. Exper., 1876.)

ORDER III.—OPHIUROIDEA (Brittle-stars).

Fam. *a.* Ophiuridæ.—*Ophiura, Ophioglypha* (fig. 26), *Ophiolepis, Ophiocoma.*

Fam. *b.* Euryalidæ.—*Asterophyton* (*Euryale*), *Asteronyx.*

(Lyman, *Ophiuridæ and Astrophytidæ*, Cat. of the Museum of Comp. Zool. at Harvard, 1865 ; Lütken, *Additamenta ad historiam Ophiuridarum*, 1859 ; Ludwig, *Morphologische Studien an Echinodermen*, 1880.)

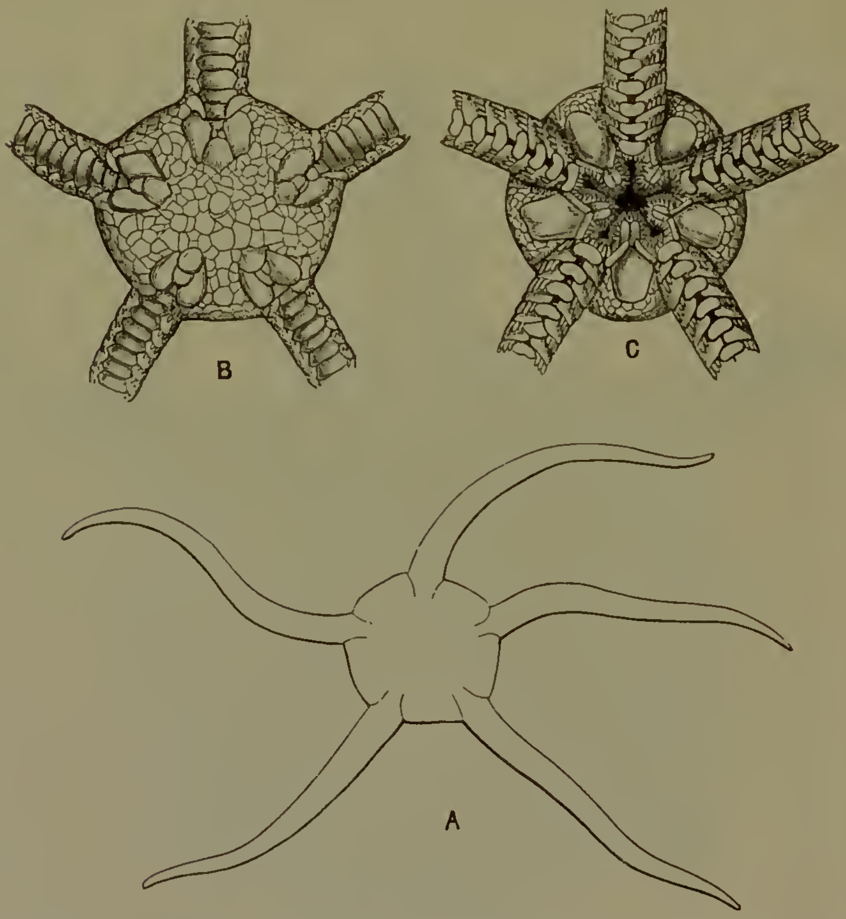

Fig. 26.—Ophiuroidea. *Ophioglypha lacertosa:* A, Outline, of the natural size; B, The disc viewed from above, twice the natural size; C, The disc viewed from below, showing the mouth and genital fissures, twice the natural size. (Original.)

ORDER IV.—HOLOTHUROIDEA (Sea-cucumbers).

Sub-ord. 1. Apneumona.

Fam. *a.* Synaptidæ.—*Synapta, Chirodota, Anapta.*
Fam. *b.* Oncinolabidæ.—*Oncinolabes.*

Sub-ord. 2. Pneumonophora.

Fam. *a.* Molpadiidæ.—*Molpadia.*
Fam. *b.* Aspidochirotæ.—*Holothuria.*
Fam. *c.* Dendrochirotæ.—*Cucumaria* (*Pentacta*), *Psolus, Thyone.*

(Selenka, *Beiträge zur Anatomie und Systematik der Holothurien*, Zeitschr. fur Wiss. Zool., 1867-68. Semper, *Reisen im Archipel der Philippinen*, 1868.)

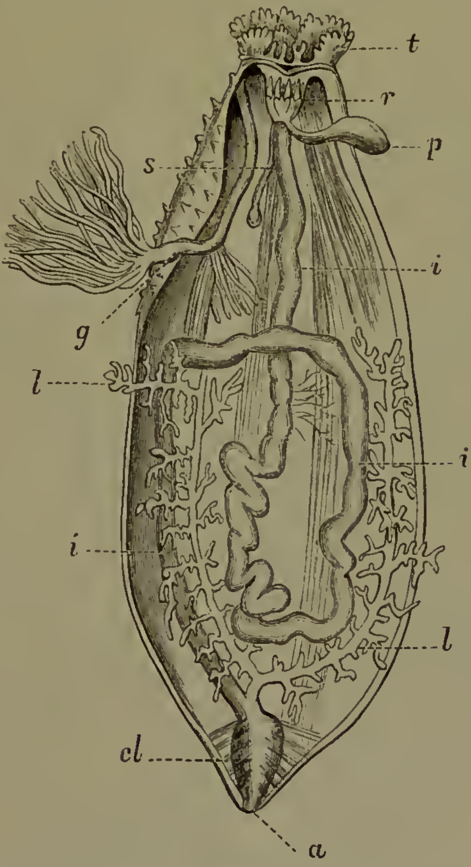

Fig. 27.—Holothuroidea. Semi-diagrammatic longitudinal section of a Holothurian. *t*, Tentacles; *r*, Calcareous ring at the base of the tentacles; *p*, Polian vesicle; *s*, Sand-canal; *i i i*, Alimentary canal; *g*, Duct of the reproductive organs; *cl*, Cloaca; *a*, Anus; *l l*, respiratory tree.

The *Holothuroidea* are often divided into primary sections, according as they possess tube-feet or not. The families which are destitute of tube-feet form the section *Apoda*, comprising the families *Synaptidæ*, *Oncinolabidæ*, and *Molpadiidæ*. On the other hand, the families of the *Aspidochirotæ* and *Dendrochirotæ* possess tube-feet, and form the section of the *Pediculata*.

Order V.—Crinoidea (Sea-lilies).

Sub-ord. 1. Tesselata.

Fam. *a.* *Cyathocrinidæ.—*Cyathocrinus, Zeacrinus.*
Fam. *b.* *Poteriocrinidæ.—*Poteriocrinus, Dendrocrinus.*
Fam. *c.* *Marsupitidæ.—*Marsupites.*
Fam. *d.* *Rhodocrinidæ.—*Rhodocrinus.*
Fam. *e.* *Taxocrinidæ.—*Taxocrinus.*
Fam. *f.* *Anthocrinidæ.—*Anthocrinus, Crotalocrinus.*
Fam. *g.* *Haplocrinidæ.—*Haplocrinus, Coccocrinus.*
Fam. *h.* *Pisocrinidæ.—*Pisocrinus, Triacrinus.*
Fam. *i.* *Actinocrinidæ.—*Actinocrinus, Periechocrinus.*
Fam. *j.* *Melocrinidæ.—*Melocrinus.*
Fam. *k.* *Platycrinidæ.—*Platycrinus.*
Fam. *l.* *Carpocrinidæ.—*Habrocrinus.*
Fam. *m.* *Eucalyptocrinidæ.—*Eucalyptocrinus.*
Fam. *n.* *Glyptocrinidæ.—*Glyptocrinus.*
Fam. *o.* *Gasterocomidæ.—*Gasterocoma.*
Fam. *p.* *Cupressocrinidæ.—*Cupressocrinus.*

Sub-ord. 2. Articulata.

Fam. *a.* *Encrinidæ.—*Encrinus.*
Fam. *b.* *Eugeniacrinidæ.—*Eugeniacrinus.*
Fam. *c.* Pentacrinidæ.—*Pentacrinus.*
Fam. *d.* Apiocrinidæ.—*Rhizocrinus, Bathycrinus, *Bourgueticrinus, *Apiocrinus.*
Fam. *e.* Holopidæ.—*Holopus, *Cyathidium.*
Fam. *f.* *Plicatocrinidæ.—*Plicatocrinus.*
Fam. *g.* Comatulidæ. — *Antedon* (including the sub-genera *Comatula, Actinometra, Solanocrinus, Phanogenia,* &c.)

The *Crinoidea* are sometimes included with the *Blastoidea* and *Cystoidea* to form a special section of *Echinodermata*, to which the name of *Pelmatozoa* is applied. If this course be followed, the *Echinoidea*, *Asteroidea*, *Ophiuroidea*, and *Holothuroidea* will constitute a second great primary division or class of Echinoderms, to which the name of *Echinozoa* may be given.

(W. B. Carpenter, *On the Structure, Physiology, and Development of Antedon rosaceus*, Phil. Trans., vol. clvi., 1876 ; M. Sars, *Mémoires pour servir à la connaissance des Crinoides vivants*, Christiania, 1868 ; Wyville Thomson, *Notice of New Living Crinoids belonging to the Apiocrinidæ*, Journ. Linn. Soc., 1876 ; P. H. Carpenter, *On the Oral and Apical Systems of Echinoderms*, Quart. Journ. Micros. Sci., vol. xviii.; Götte, *Vergleichende Entwickelungsgeschichte der Comatula Mediterranea*, Archiv für Mikros. Anat., 1876 ; Schultze, *Monographie der Echinodermen der Eifler Kalk*, Denkschr. der K. Akad. der Wiss., 1876.)

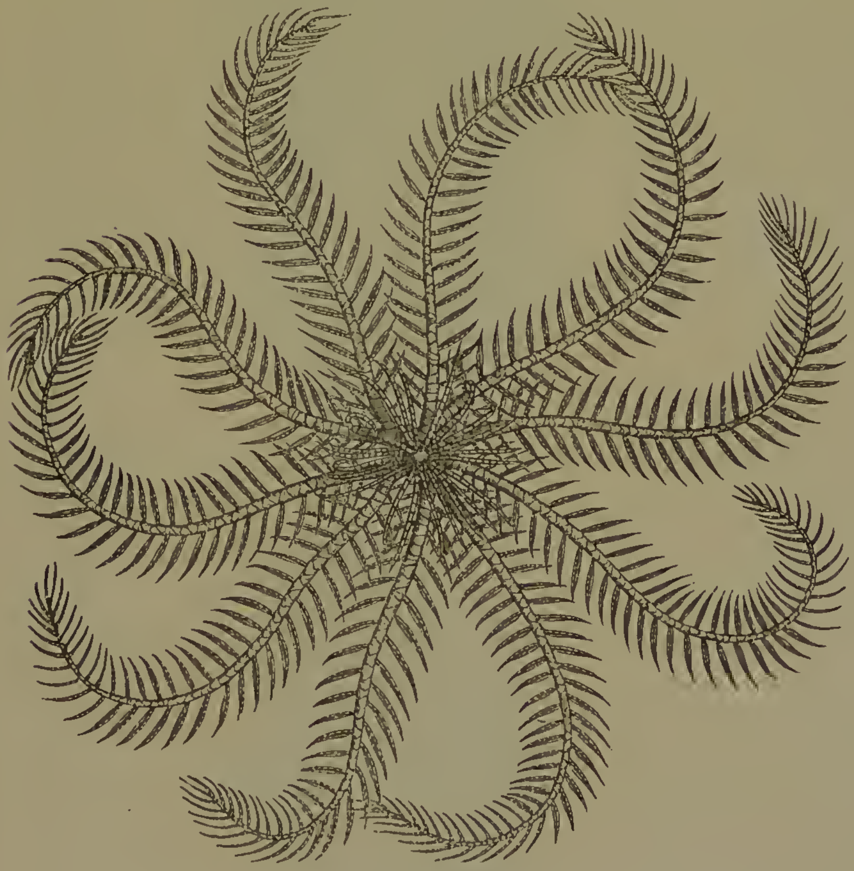

Fig. 28.—Crinoidea. *Comatula rosacea*, a free Crinoid, viewed from its dorsal or aboral aspect.

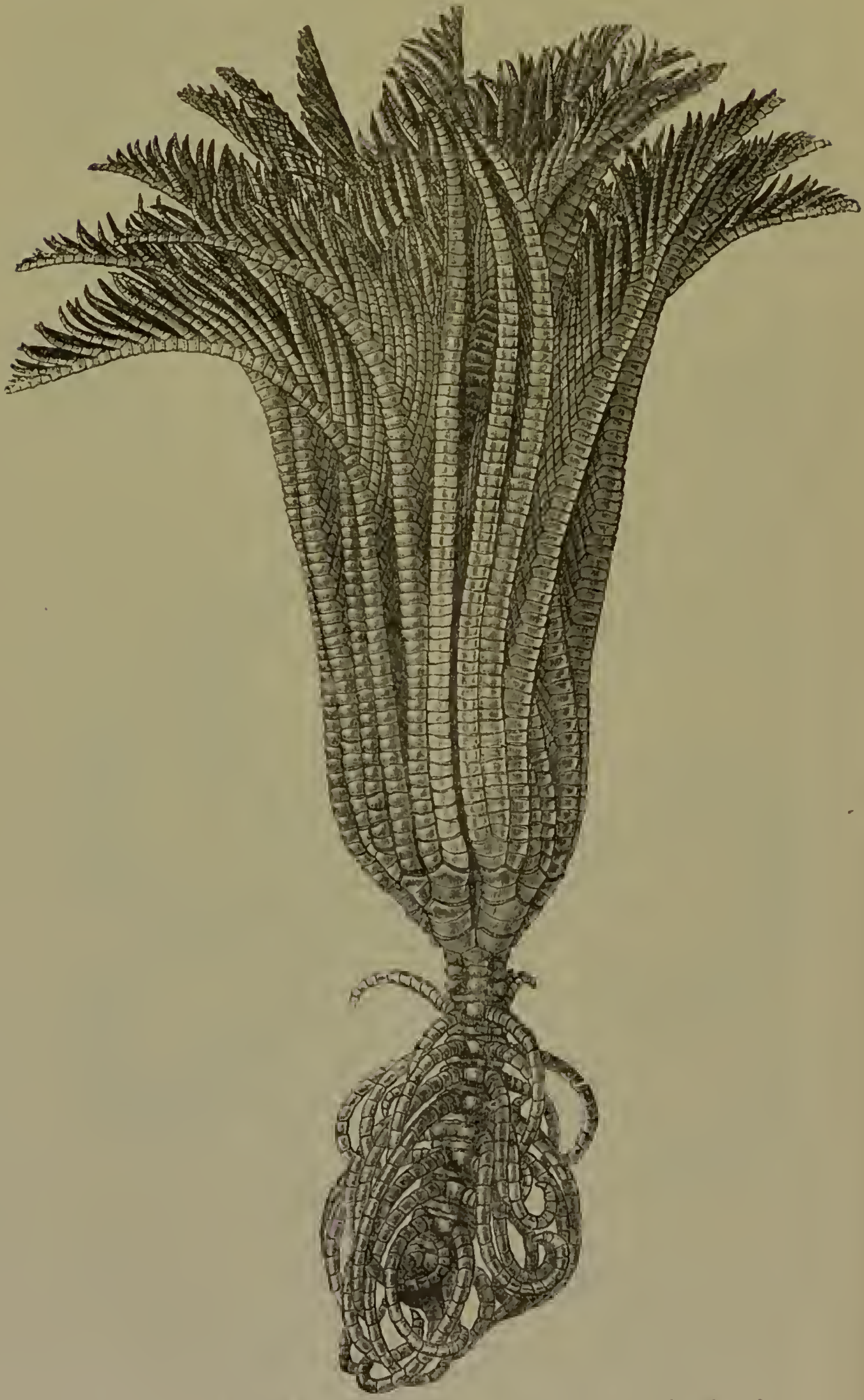

Fig. 29.—*Pentacrinus Macleayanus*, a living stalked Crinoid, slightly enlarged.

ORDER VI.—*CYSTOIDEA.

Sub-ord. 1. Aporitidæ.—*Cryptocrinus, Malocystites.*
Sub-ord. 2. Diploporitidæ.—*Sphæronites, Glyptosphærites.*
Sub-ord. 3. Rhombiferi. — *Caryocrinus, Hemicosmites, Echinoencrinus.*

(Von Buch, *Ueber Cystideen,* Berlin, 1845 ; Billings, *On the Cystidea of the Lower Silurian Rocks of Canada,* 1858.)

ORDER VII.—*BLASTOIDEA.—*Pentremites, Nucleocrinus, Granatocrinus.*

(Ferd. Roemer, *Monographie der fossilen Crinoiden-familie der Blastoiden und der Gattung Pentatrematites im Besonderen,* Berlin, 1852.)

SUB-KINGDOM (TYPE) IV.—ANNULOSA.

The body is usually more or less elongated, and is always bilaterally symmetrical, instead of being radially disposed. Typically, the body is composed of morphologically similar segments, which may be definite or indefinite, and which are arranged along a longitudinal axis. Lateral appendages may be absent or present, and when present are bilaterally disposed. A nervous system is present, consisting, in the lower forms, of one or two anteriorly-placed ganglia, but having typically the form of a ventrally-placed, double, gangliated chain.

DIVISION I.—SCOLECIDA.

CLASS I.—PLATYELMIA (Flat-worms).

ORDER I.—TÆNIOIDEA (CESTOIDEA).

Fam. *a.* Tæniada.—*Tænia* (fig. 30).
Fam. *b.* Bothriocephalidæ (Dibothridæ). — *Bothriocephalus.*
Fam. *c.* Diphyllidæ.—*Echinobothrium.*
Fam. *d.* Tetraphyllidæ.—*Phyllobothrium.*
Fam. *e.* Tetrarhynchidæ.—*Tetrarhynchus.*
Fam. *f.* Ligulidæ.—*Ligula.*
Fam. *g.* Caryophyllæidæ.—*Caryophyllæus.*

(Van Beneden, *Les vers Cestoïdes*, Mém. Acad. de Bruxelles, 1850; Leuckart, *Die Blasenbandwürmer und ihre Entwickelung*, Giessen, 1856; Spencer Cobbold, *Entozoa, An Introduction to the Study of Helminthology*, 1864.)

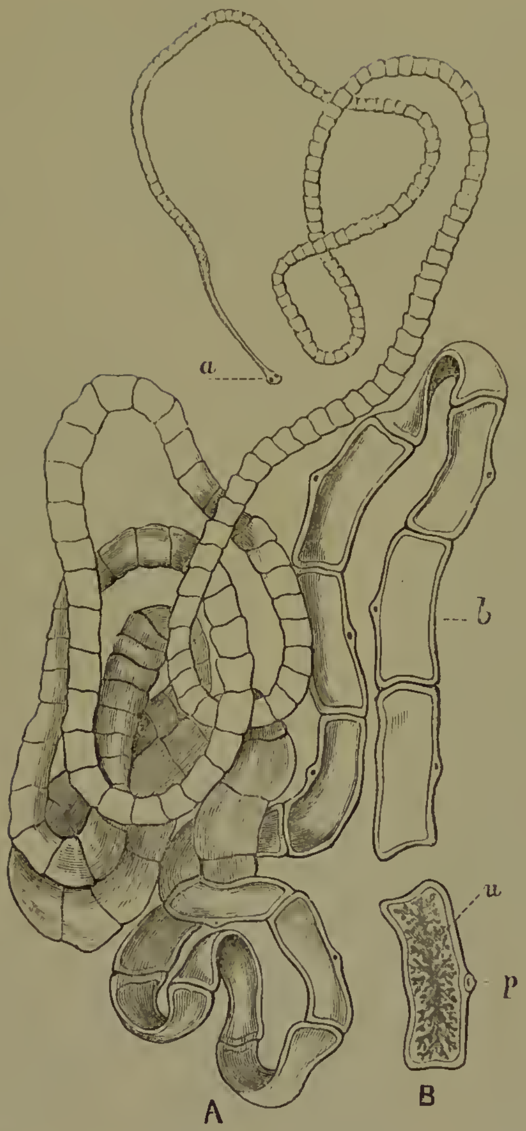

Fig. 30.—Tænioidea. A, *Tænia solium*, of the natural size: *a*, "Head" or "nurse;" *b*, One of the proglottides from the sexually mature part of the worm. B, A single mature proglottis of the same, showing the genital pore (*p*) and the branched uterus (*u*).

ORDER II.—TREMATODA.

Sub-ord. 1. Distomata (Digenea).—*Monostomum, Diplostoma, Distoma* (fig. 31), *Gynæcophorus.*

Sub-ord. 2. Polystomata (Monogenea).—*Polystomum, Tristoma, Diplozoön, Gyrodactylus.*

Myzostoma is a singular little organism, found living as a parasite upon *Comatula* and other Crinoids, and showing many points of affinity to the

Trematode Worms. The possession, however, of a series of rudimentary feet, provided with hooks, is a character which would separate it from the Trematodes, and would rather indicate an alliance with the Chætopod Annelides.

(Pagenstecher, *Trematoden-larven und Trematoden*, Heidelberg, 1857; Van Beneden and Hesse, *Bdellodes et Trématodes marins*, Mém. Acad. de Bruxelles, 1863 and 1865; Sommer, *Anatomie des Leberegels, Distoma hepaticum*, Zeitschr. für Wiss. Zool., 1880.)

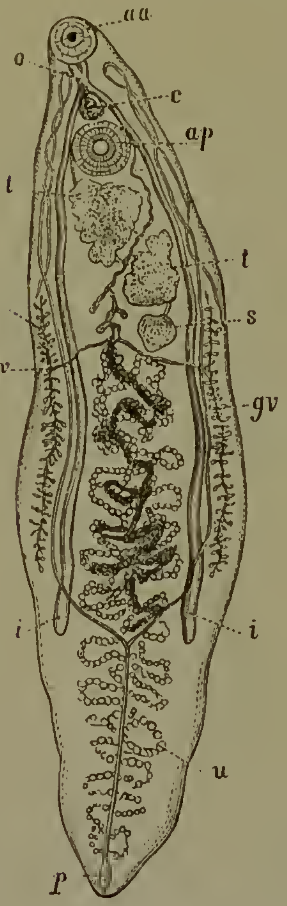

Fig. 31.—A Trematode Worm (*Distoma lanceolatum*), enlarged. *aa*, Anterior sucker, with the mouth at its bottom; *ap*, Posterior sucker; o, Gullet, dividing behind into the two branches of the intestine, which are unbranched, and terminate behind in blind extremities (*i i*); *p*, External opening of the water-vessels, which divide above so as to cross the blind ends of the intestine. The remaining letters refer to the different parts of the reproductive organs.

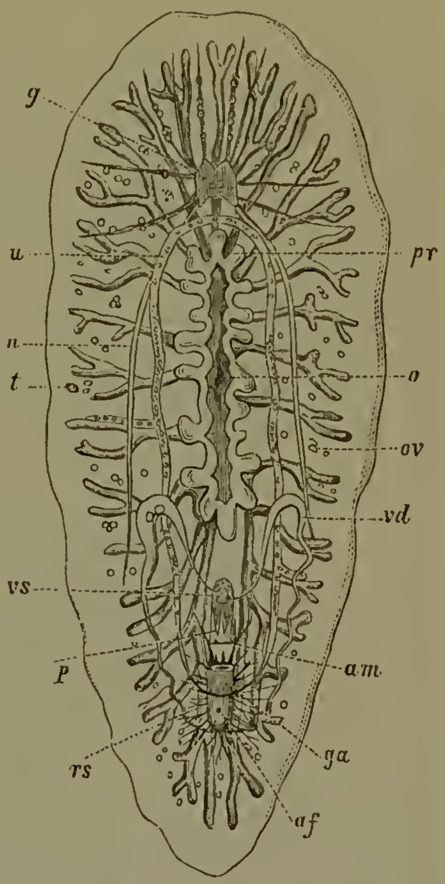

Fig. 32.—One of the Turbellarian Worms (*Leptoplana tremellaris*), enlarged. *o*, Mouth; *pr*, Proboscis; *g*, The principal nerve-ganglion, placed in the anterior part of the body, and giving off numerous radiating branches (*n*); *p*, Penis; *vd*, Vas deferens; *vs*, Vesicula seminalis; *am*, Opening of male reproductive organs; *t*, Testis; *ov*, Ovary; *u*, Uterus, partly filled with eggs; *af*, Opening of the female reproductive organs; *rs*, Receptaculum seminis; *ga*, Albuminiparous gland.

Order III.—Turbellaria.

Sub-ord. 1. Planarida.

Section A. Rhabdocœla.—*Prostomum, Opisthomum, Macrostomum, Convoluta.*

Section B. Dendrocœla. — *Planaria, Geoplana, Leptoplana* (fig. 32), *Polycelis.*

Sub-ord. 2. Nemertida (Ribbon-worms).

Section A. Anopla.—*Lineus, Borlasia.*

Section B. Enopla.—*Nemertes, Tetrastemma.*

Section C. Pelagonemertida.—*Pelagonemertes* (fig. 33).

(Max Schultze, *Beiträge zur Naturgeschichte der Turbellarien*, Greifswald, 1851; Oersted, *Entwurf einer Systematischen und Speciellen Beschreibung der Plattwürmer*, Copenhagen, 1844; M'Intosh, *A Monograph of the British Nemerteans*, Ray Society, 1873-74.)

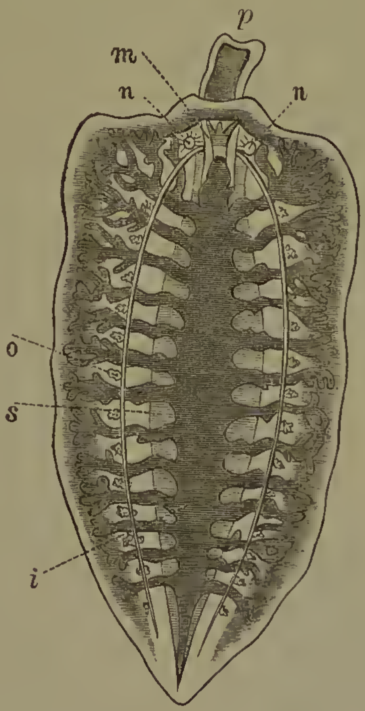

Fig. 33.—Nemertida. *Pelagonemertes Rollestoni*, a pelagic Nemertid, viewed from the ventral surface. *p*, Proboscis, partially protruded; *m*, Opening of the mouth; *i*, Alimentary canal, with its lateral diverticula, shaded darkly; *s*, The sheath of the proboscis, more lightly shaded; *n n*, The nerve-ganglia, placed one on each side of the mouth, and each giving off long lateral and backwardly-directed branch, external to which, on each side, is a row of ovaries (*o*). (After Moseley.)

CLASS II.—NEMATELMIA (Round-worms).

ORDER I.—ACANTHOCEPHALA.—*Echinorhynchus* (fig. 34).

(Pagenstecher, *Echinorhynchus proteus*, Zeitschr. für Wiss. Zool., 1863; Lindemann, *Anatomie der Acanthocephalen*, Moscow, 1865; Von Linstow, *Zur Anatomie und Entwickelung von Echinorhynchus angustatus*, Archiv für Naturg., 1872.)

ORDER II.—GORDIACEA (Hair-worms).

Fam. *a.* Sphærulariidæ.—*Sphærularia.*
Fam. *b.* Gordiidæ.—*Gordius* (fig. 35).
Fam. *c.* Mermitidæ.—*Mermis.*

(Lubbock, *On Sphærularia bombi*, Natural History Review, 1861; A. Villot, *Monographie des Dragoneaux* (Gordiidæ), Archives de Zool. Expér., 1874.)

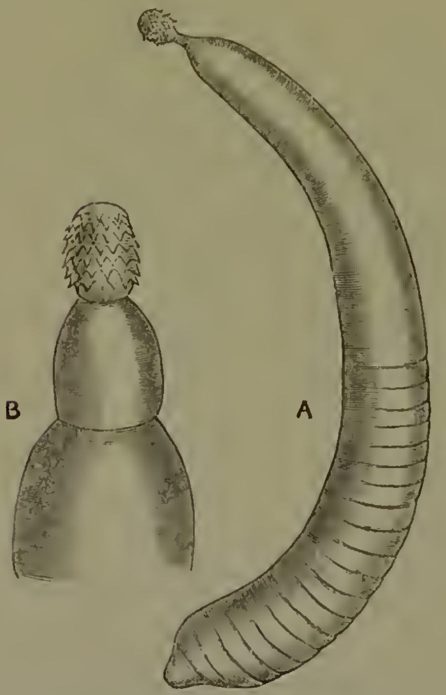

Fig. 34.—Acanthocephala. A, *Echinorhynchus gigas*, slightly enlarged. B, Head of the same, still further enlarged.

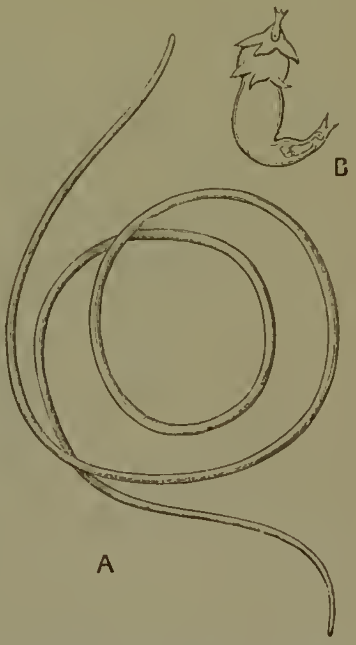

Fig. 35.—Gordiacea. A, A small individual of *Gordius aquaticus*, of the natural size. B, Larva of *Gordius subfurcatus*, with its piercing proboscis and two rows of hooks, enlarged.

ORDER III.—NEMATODA (NEMATOIDEA).

Section A. Acrophalli.

Fam. *a.* Trichocephalidæ (Trichotrachelidæ).— *Trichocephalus.*

Fam. *b.* Trichinidæ. — *Trichina.*

Fam. *c.* Strongylidæ. — *Eustrongylus, Syngamus, Dochmius, Sclerostoma.*

Section B. Hypophalli.

Fam. *a.* Spiruridæ.—*Spiroptera.*

Fam. *b.* Cucullanidæ (Cephalota).—*Cucullanus.*

Fam. *c.* Filariidæ.—*Filaria.*

Fam. *d.* Ascarida.—*Ascaris, Oxyuris.*

Fam. *e.* Cheiracanthidæ. — *Cheiracanthus.*

Fam. *f.* Anguillulidæ. — *Rhabditis* (fig. 36), *Tylenchus, Dorylaimus.*

The genera *Chætosoma* and *Rhabdogaster* include certain singular, free-living, marine worms, which have a close relationship in their internal anatomy with the ordinary Nematodes, but which have the peculiarity that the ventral surface carries a double row of bristles placed in front of the anus. If these types are included in the *Nematoda*, they must be regarded as forming a special section of the order.

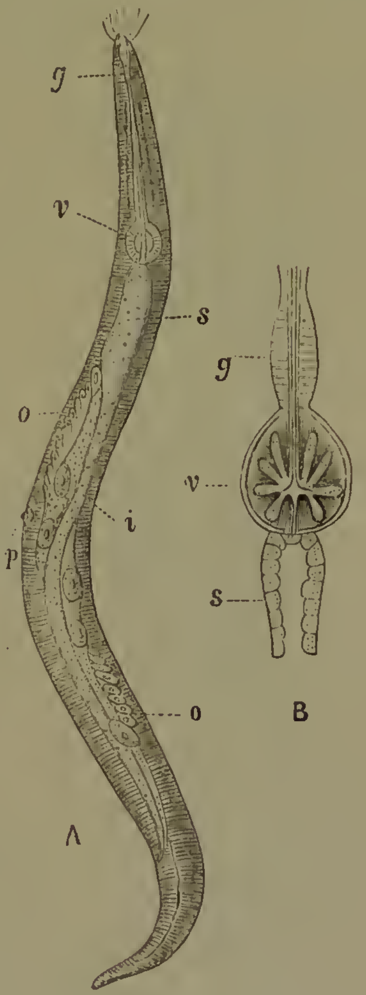

Fig. 36.—Nematoda. A, *Rhabditis bioculata*, female, enlarged. B, Portion of the alimentary tract of *Oxyuris vermicularis*, enlarged: *g*, Gullet; *v*, Muscular gizzard; *s*, Chylific stomach, or anterior end of the intestine (*i*); *oo*, Ovaries; *p*, Genital pore.

(Bastian, *Monograph of the Anguillulidæ or Free Nematoids*, Linn. Trans., 1865; Schneider, *Monographie der Nematoden*, Berlin, 1866; Leuckart, *Die Menschlichen Parasiten*, Bd. II., 1876.)

CLASS III.—ROTIFERA (ROTATORIA, Wheel-animalcules).

ORDER I.—HOLOTROCHA.—*Œcistes, Conochilus.*

ORDER II.—SCHIZOTROCHA.

Fam. *a.* Megalotrochidæ.—*Megalotrocha.*

Fam. *b.* Floscularidæ. — *Floscularia, Melicerta, Stephanoceros.*

Fam. *c.* Hydatinidæ.—*Hydatina, Eosphora* (fig. 37), *Notommata, Polyarthra, Euchlanis.*

ORDER III.—ZYGOTROCHA.

Fam. *a.* Philodinidæ.—*Philodina, Rotifer.*

Fam. *b.* Brachionidæ.—*Brachionus.*

ORDER IV.—GASTRODELA.

Fam. *a.* Asplanchnidæ. — *Asplanchna.*

ORDER V.—PARASITICA.

Fam. *a.* Albertiidæ. — *Albertia, Balatro.*

ORDER VI.—GASTROTRICHA.

Fam. *a.* Chætonotidæ. — *Ichthydium, Chætonotus.*

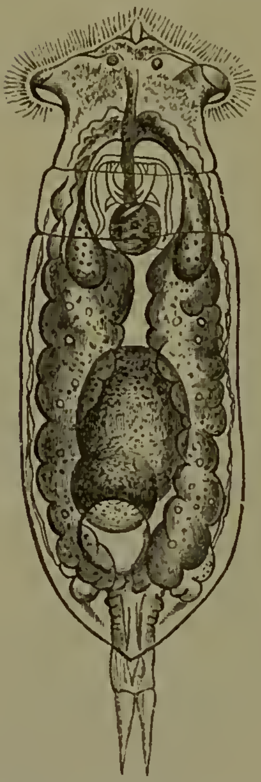

Fig. 37. — Rotifera. *Eosphora aurita*, enlarged 250 diameters. (After Gosse.)

The *Chætonotidæ*, or Hairy-backed Animalcules, constitute an aberrant group of Rotifers, and are often placed among the *Turbellaria*, or regarded as belonging to the Oligochætous Annelides.

The genera *Albertia*, *Seison*, and *Balatro* comprise certain abnormal Rotifers, in which there is no wheel-organ, and the cilia are either greatly reduced or wholly wanting. They are ecto- or endo-parasites.

The genus *Pedalion* comprises Rotifers with limb-like appendages, moved by special muscles, and it is sometimes regarded as the type of a special section of the Rotifers (*Arthroptera*).

The genus *Echinoderes*, lastly, includes certain minute marine organisms, in which the body is imperfectly segmented, but there are no limbs. The anterior segment of the body is furnished with hooklets, and constitutes a protrusible proboscis. The genus forms a link between the Scolecids and the higher Annulosa.

(Leydig, *Ueber den Bau und die systematische Stellung der Räderthiere*, Zeitschr. für Wiss. Zool., 1851 and 1854; Gosse, *On the Structure, Functions, and Homologies of the Manducatory Organs of the Class Rotifera*, Phil. Trans., 1856; Grenacher, *Beobachtungen über Räderthiere*, Zeitschr. für Wiss. Zool., 1869; Huxley, *Lacinularia socialis*, Trans. Micros. Soc., 1853.)

DIVISION II.—ANARTHROPODA.

CLASS I.—GEPHYREA (Spoon-worms).

ORDER I.—GEPHYREA INERMIA.

Fam. *a.* Priapulidæ.—*Priapulus.*

Fam. *b.* Sipunculidæ.—*Sipunculus* (fig. 38), *Phascolosoma.*

ORDER II.—GEPHYREA ARMATA.

Fam. *a.* Echiuridæ.—*Echiurus, Thalassema.*

Fam. *b.* Bonelliadæ.—*Bonellia.*

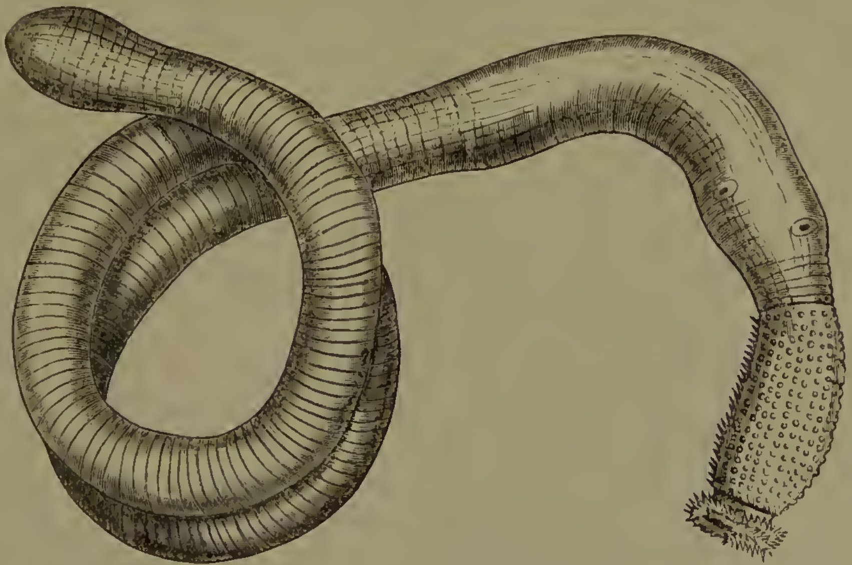

Fig. 38.—Gephyrea. *Sipunculus Indicus*, of the natural size. (After Keferstein.)

The genus *Sternaspis*, which has been often placed among the *Gephyrea*, is now regarded as an Annelide.

The genus *Phoronis*, on the other hand, usually placed among the Tubicolar Annelides, is sometimes looked upon as the type of a special section of *Gephyrea.*

(Keferstein, *Beiträge zur anatomischen und systematischen Kenntniss der Sipunculiden*, Zeitschr. für Wiss. Zool., 1865 and 1867; Semper, *Mittheilungen über Sipunculiden*, Zeitschr. für Wiss. Zool., 1864.)

CLASS II.—ANNELIDA (Ringed Worms).

ORDER I.—HIRUDINEA (DISCOPHORA, LEECHES).

Fam. *a.* Malacobdellidæ.—*Malacobdella.*
Fam. *b.* Acanthobdellidæ.—*Acanthobdella.*
Fam. *c.* Branchiobdellidæ.—*Branchiobdella.*
Fam. *d.* Clepsinidæ.—*Clepsine, Piscicola* (fig. 39).
Fam. *e.* Hirudinidæ.—*Sanguisuga* (*Hirudo*), *Trochetia, Nephelis* (fig. 39), *Hæmopsis, Pontobdella* (fig. 39).

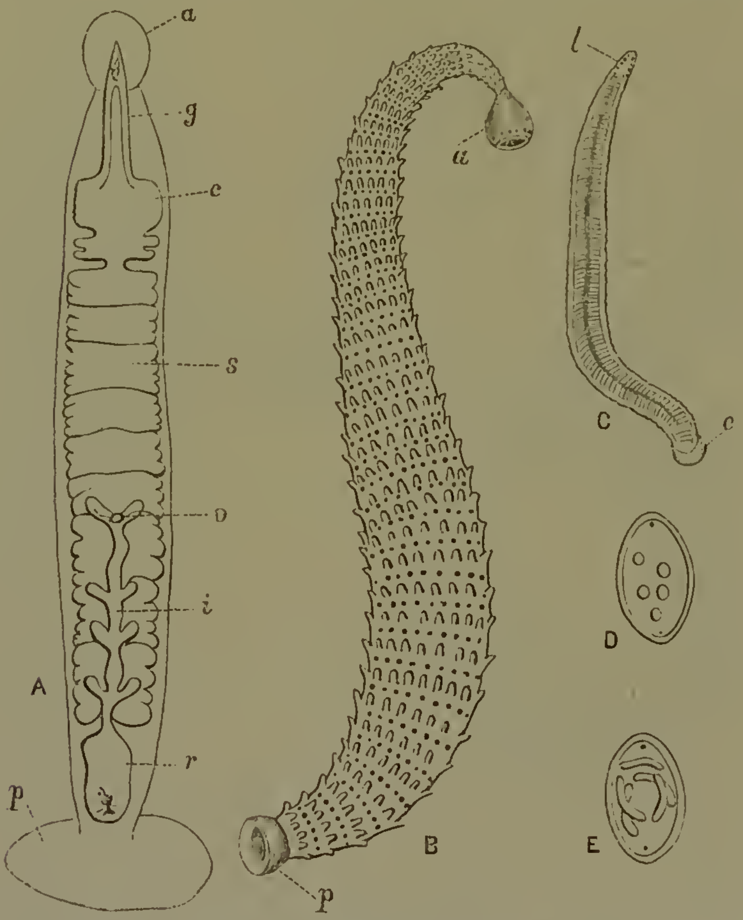

Fig. 39.—Hirudinea. A, Semi-diagrammatic view of *Piscicola geometrica*, enlarged: *a*, The anterior, and *p*, the posterior sucker; *g*, The pharynx, with the proboscis; *c*, The proventriculus; *s*, The proper stomach; *o*, Sphincter separating the stomach from the intestine; *i*, Intestine, with lateral cæca; *r*, Rectum, terminating in the aperture of the anus. B, *Pontobdella muricata*, of the natural size: *a*, Anterior, and *p*, posterior sucker. C, *Nephelis octoculata*, viewed from above, of the natural size: *l*, Upper lip, carrying the eye-spots; *c*, Posterior sucker. D, Cocoon of the preceding, with eggs, enlarged. E, An older cocoon of the same, with young leeches, enlarged. (After Leydig and Moquin-Tandon.)

The genus *Malacobdella* is sometimes regarded as belonging to the *Nemertida*. The genus *Histriobdella* is of doubtful affinities, but is usually referred to the present order.

(Moquin-Tandon, *Monographie de la Famille des Hirudinées*, 1846; Leydig, *Zur Anatomie von Piscicola geometrica*, Zeitschr. für Wiss. Zool., 1849; Dorner, *Ueber die Gattung Branchiobdella*, Zeitschr. für Wiss. Zool., 1865.)

(Claparède, *Recherches anatomiques sur les Oligochætes*, Geneva, 1862; Lankester, *On the Anatomy of the Earthworm*, Journ. Micros. Sci., 1864, 1865; Ratzel, *Beiträge zur anatomischen und systematischen Kenntniss der Oligochæten*, Zeitschr. für Wiss. Zool., 1868.)

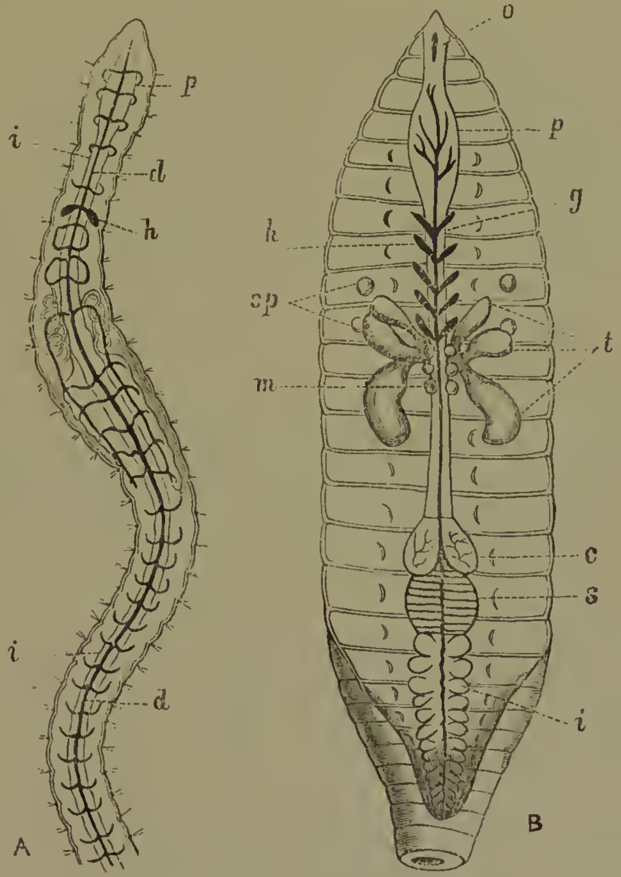

Fig. 40.—Oligochæta. A, Anterior portion of *Tubifex rivulorum*, enlarged: *p*, Pharynx; *i i*, Alimentary canal; *d d*, Dorsal vessel; *h*, One of the "hearts" or contractile dilatations of the pseudohæmal vessels. B, Anterior portion of *Lumbricus terrestris*, laid open and enlarged: *o*, Mouth; *p*, Pharynx; *g*, Gullet; *m*, Œsophageal glands; *c*, Proventriculus; *s*, Gizzard; *i*, Intestine; *h*, One of the "hearts," borne on the side of the dorsal vessel; *t*, Testes; *sp*, Spermathecæ. (After Lankester.)

ORDER II.—OLIGOCHÆTA.

Fam. *a.* Naiididæ.—*Nais, Aeolosoma.*
Fam. *b.* Enchytræidæ.—*Enchytræus, Chætogaster.*
Fam. *c.* Sænuridæ.—*Tubifex* (*Sænuris*), (fig. 40), *Limnodrilus.*
Fam. *d.* Lumbricidæ.—*Lumbricus* (Earthworm), *Criodrilus.*

ORDER III.—POLYCHÆTA.

Sub-ord. 1. Tubicola (Sedentaria).

Fam. *a.* Hermellidæ.—*Sabellaria* (*Hermella*).
Fam. *b.* Terebellidæ.—*Terebella, Amphitrite.*
Fam. *c.* Amphictenidæ.—*Pectinaria.*
Fam. *d.* Sabellidæ.—*Sabella, Amphicora.*
Fam. *e.* Serpulidæ.—*Serpula, Spirorbis, Filograna.*

Sub-ord. 2. Errantia.

Fam. *a.* Aphroditidæ.—*Aphrodite* (Sea-mouse).
Fam. *b.* Polynoidæ.—*Polynoe, Lepidonotus, Halosydna.*
Fam. *c.* Sigalionidæ.—*Sigalion.*
Fam. *d.* Nephthydidæ.—*Nephthys.*
Fam. *e.* Phyllodocidæ.—*Phyllodoce.*
Fam. *f.* Hesionidæ.—*Castalia.*
Fam. *g.* Syllidæ.—*Syllis, Autolytus.*
Fam. *h.* Nereidæ.—*Nereis, Alitta.*
Fam. *i.* Lumbriconereidæ.—*Lumbriconereis.*
Fam. *j.* Eunicidæ.—*Eunice.*
Fam. *k.* Amphinomidæ.—*Amphinome.*
Fam. *l.* Glyceridæ.—*Glycera.*
Fam. *m.* Telethusidæ.—*Arenicola.*
Fam. *n.* Spionidæ.—*Nerine, Spio.*
Fam. *o.* Cirratulidæ.—*Cirratulus.*
Fam. *p.* Tomopteridæ.—*Tomopteris.*

Only the principal families of the *Annelida* are given above. The genus *Tomopteris* is often considered as forming a special section of the Polychætous Annelides, to which the name of *Gymnocopa* (Grube) has been given. The aberrant genus *Polygordius* is also sometimes referred to a special division of the *Annelida*, characterised, among other things, by the absence of setæ and parapodia.

(Quatrefages, *Histoire Naturelle des Annelés marins et d'eau douce*, Paris, 1865; M'Intosh, Article "*Annelides*," Encyclop. Britann., 1875; Ehlers, *Die Borstenwürmer*, Leipzig, 1864 and 1868.)

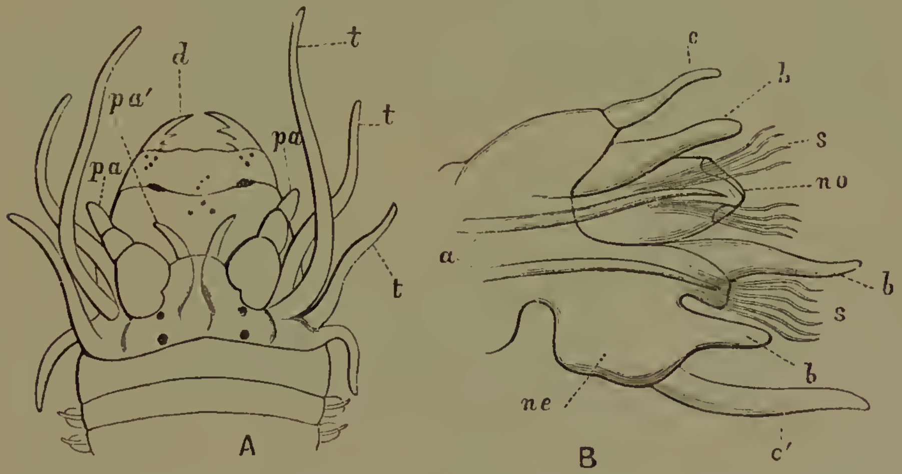

Fig. 41.—Annelida. A, Head of *Nereis incerta*, viewed from beneath, and enlarged (after Quatrefages): *d*, The principal pair of chitinous jaws (the dark dots on the lobe behind these are smaller denticles); *pa′*, Internal pair of palpi; *pa*, External or greater pair of palpi; *t t t*, Tentacles. B, Foot-tubercle of *Nereis*, enlarged: *no*, Notopodium; *ne*, Neuropodium; *c*, Dorsal cirrus; *c′*, Ventral cirrus; *b b b*, Branchial filaments; *a*, Aciculæ; *s s*, Setæ attached to the dorsal and ventral oars.

CLASS III.—CHÆTOGNATHA (Arrow-worms).

Genus *Sagitta* (fig. 42).

(Krohn, *Anatomisch-physiologische Beobachtungen über die Sagitta bipunctata*, Hamburg, 1844; Gegenbaur, *Ueber die Entwickelung der Sagitta*, Halle, 1856; Busk, *Species of Sagitta*, Quart. Journ. Micros. Sci., 1856.)

The genus *Balanoglossus* is an aberrant type, which is sometimes placed in the neighbourhood of the Nemertean worms; while others regard it as the representative of a special section of the *Anarthropoda*, to which the name of *Enteropneusta* is applied.

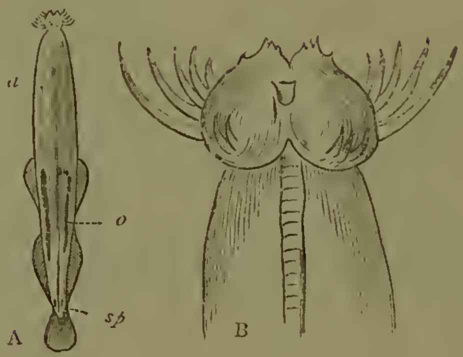

Fig. 42.—Morphology of *Chætognatha*. A, *Sagitta tricuspidata*, of the natural size: *o*, One of the ovaries; *sp*, Orifice of one of male organs of reproduction. B, Head of the same, viewed from beneath and greatly enlarged, showing the horny, setiform jaws. (After Saville Kent.)

DIVISION III.—ARTHROPODA.

CLASS I.—CRUSTACEA.

SUB-CLASS I.—EPIZOA.

ORDER I.—ICHTHYOPHTHIRA.—*Lernæa*, *Achtheres*, *Tracheliastes* (fig. 43), *Diocus* (fig. 43), *Chondracanthus*, *Nicothoe*, *Caligus*.

The *Ichthyophthira* do not form a natural division of the *Crustacea*, but may rather be more properly regarded as comprising types which are fundamentally allied to the Copepods, but which have undergone degradation in consequence of their parasitic mode of life.

(Nordmann, *Neue Beiträge zur Kenntniss parasitischen Copepoden*, Bull. de la Soc. des nat. de Moscou, 1864; Claus, *Beobachtungen über Lernæocera, Peniculus, und Lernæa*, Marburg, 1868; Claus, *Ueber den Bau und die Entwickelung von Achtheres percarum*, Zeitschr. für Wiss. Zool., 1861.)

ORDER II.—RHIZOCEPHALA.—*Sacculina*, *Peltogaster*, *Lernæodiscus*.

(Fr. Müller, *Die Rhizocephalen*, Archiv für Naturg., 1874.)

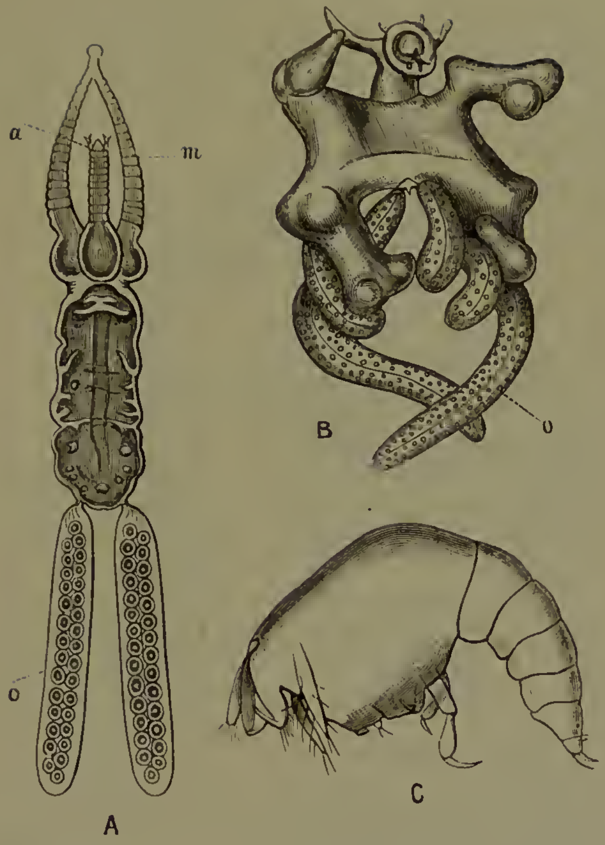

Fig. 43.—Ichthyophthira. A, Female of *Tracheliastes polycolpus*, enlarged about eight times (after Nordmann): *m*, Second pair of maxillipedes, united at their extremities to form an adhesive disc; *a*, Prehensile antennæ; *o*, Ovisacs. B, Female of *Diocus gobinus*, enlarged four times: *o*, Ovisacs. C, Pigmy male of the preceding, enlarged thirty-eight times. (After Steenstrup and Lütken.)

ORDER III.—CIRRIPEDIA.

Sub-ord. 1. Thoracica.

Fam. *a*. Balanidæ (Acorn-shells).—*Balanus*, *Pyrgoma*, *Coronula*, *Chthamalus*.
Fam. *b*. Verrucidæ.—*Verruca*.
Fam. *c*. Lepadidæ (Barnacles).—*Lepas* (fig. 44), *Pœcilasma*, *Pollicipes*, *Scalpellum*.

Sub-ord. 2. Abdominalia.—*Cryptophialus*.

Sub-ord. 3. Apoda.—*Protolepas*.

(Darwin, *A Monograph of the Sub-class Cirripedia*, Ray Society, 1851-54; Pagenstecher, *Beiträge zur Anatomie und Entwickelungsgeschichte von Lepas pectinata*, Zeitschr. für Wiss. Zool., 1863; Von Willemoës-Suhm, *On the Development of Lepas fascicularis and the 'Archizoea' of the Cirripedia*, Phil. Trans., 1876.)

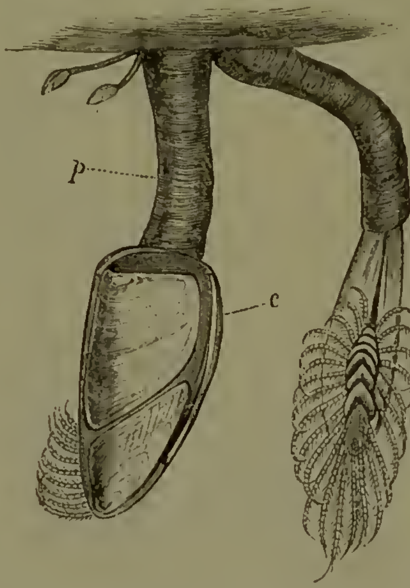

Fig. 44.—Two fully grown individuals of the common Barnacle (*Lepas anatifera*), growing upon a foreign body. *p*, The stalk of attachment; *c*, The body of the animal enclosed in a shell, from which the legs can be protruded.

SUB-CLASS II.—ENTOMOSTRACA.

ORDER I.—OSTRACODA.

Sub-ord. 1. Podocopa.

Fam. *a.* Cypridæ.—*Cypris* (fig. 45), *Candona.*
Fam. *b.* Cytheridæ.—*Cythere*, *Limnocythere.*

Sub-ord. 2. Mydocopa.

Fam. *a.* Cypridinidæ.—*Cypridina* (fig. 45), **Entomis.*
Fam. *b.* Entomoconchidæ.—*Heterodesmus.*
Fam. *c.* Conchœciadæ.—*Halocypris.*

Sub-ord. 3. Cladocopa.

Fam. *a.* Polycopidæ.—*Polycope.*

Sub-ord. 4. Platycopa.

Fam. *a.* Cytherellidæ—*Cytherella.*

(G. S. Brady, *A Monograph of the Recent British Ostracoda*, Trans. Linn. Soc., 1866 ; G. O. Sars, *Översigt af Norges marine Ostracoder*, 1865.)

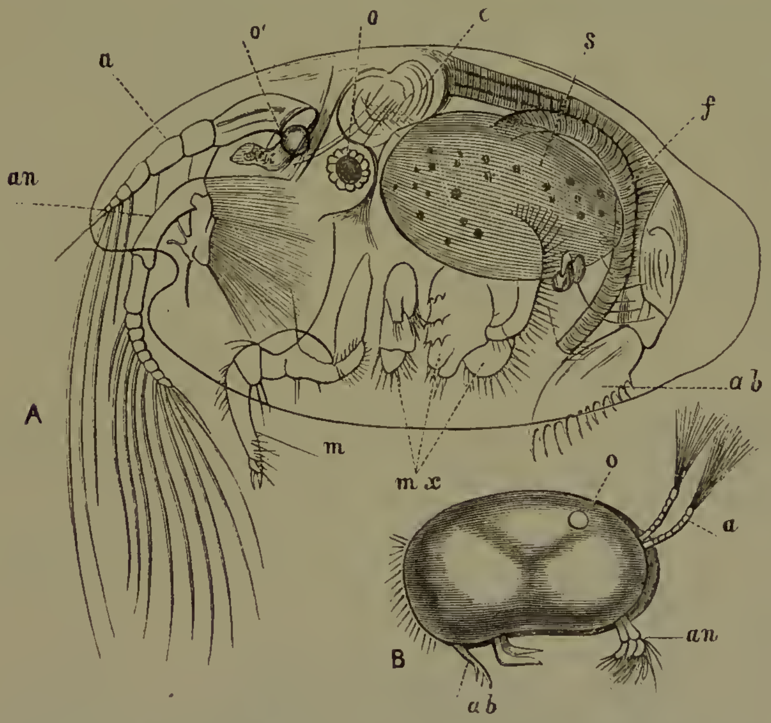

Fig. 45.—Ostracoda. A, *Cypridina Messinensis*, viewed from the side, and greatly enlarged, one-half of the shell being removed ; B, *Cypris fusca*, viewed from the side, and less highly magnified, the shell-valves being retained, but slightly displaced : *a*, Antennules ; *an*, Antennæ ; *o*, Eye ; *o′*, Ocellus ; *c*, Heart ; *s*, Stomach ; *f*, Whip-like appendage for the retention of the brood ; *ab*, Extremity of the abdomen ; *m*, Mandibular appendage ; *mx*, The first, second, and third maxillæ.

ORDER II.—COPEPODA.

Fam. *a.* Cyclopidæ.—*Cyclops* (fig. 46), *Cyclopina.*
Fam. *b.* Calanidæ.—*Calanus, Pontella.*
Fam. *c.* Notodelphyidæ.—*Notodelphys.*
Fam. *d.* Harpacticidæ.—*Harpacticus.*

(G. S. Brady, *A Monograph of the Free and Semi-parasitic Copepoda of the British Islands*, Ray Society, 1878-79 ; Claus, *Die frei-lebenden Copepoden*, Leipzig, 1863.)

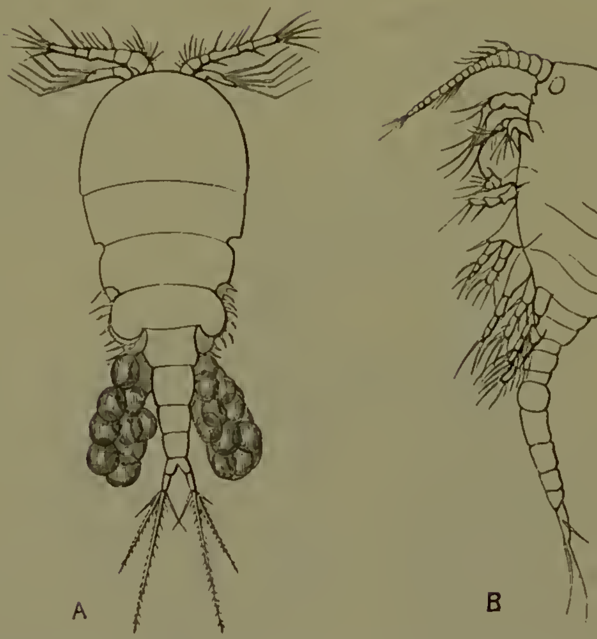

Fig. 46.—Copepoda. A, Female of *Cyclops æquoreus*, seen from above, and greatly enlarged, with the external ovisacs. B, Female of *Cyclopina littoralis*, viewed from one side, and greatly enlarged. (After G. S. Brady.)

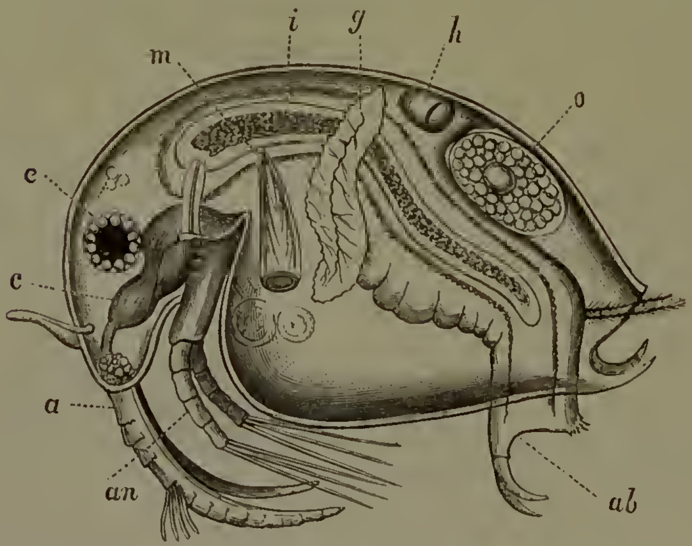

Fig. 47.—Cladocera. *Bosmina lævis*, greatly enlarged, the internal organs showing through the translucent shell: *a*, Antennules; *an*, Antennæ; *c*, Cephalic ganglion, terminating in front in a mass of ganglion-cells at the base of the antennules; *e*, Eye; *m*, Mandible; *i*, Alimentary canal; *g*, Shell-gland; *h*, Heart; *o*, Ovum contained in the brood sac; *ab*, Extremity of the abdomen, with terminal claw-like appendages. (After Leydig.)

ORDER III.—CLADOCERA.

Fam. *a.* Daphniidæ.—*Daphnia, Bosmina* (fig. 47).
Fam. *b.* Lynceidæ.—*Lynceus.*
Fam. *c.* Polyphemidæ.—*Polyphemus.*
Fam. *d.* Sididæ.—*Sida, Daphnella.*

(Leydig, *Naturgeschichte der Daphniden*, 1860; Norman and Brady, *A Monograph of the British Entomostraca belonging to the families Bosminidæ, Macrothricidæ, and Lynceidæ*, Nat. Hist. Trans. Northumberland and Durham, 1867.)

ORDER IV.—PHYLLOPODA.

Fam. *a.* Apodidæ.—*Apus* (fig. 48), *Lepidurus.*
Fam. *b.* Branchipodidæ.—*Branchipus, Artemia.*
Fam. *c.* Estheriidæ.—*Estheria, Limnadia.*
Fam. *d.* Nebaliidæ.—*Nebalia* (fig. 48).
Fam. *e.* *Peltocaridæ.—*Peltocaris, Aptychopsis.*

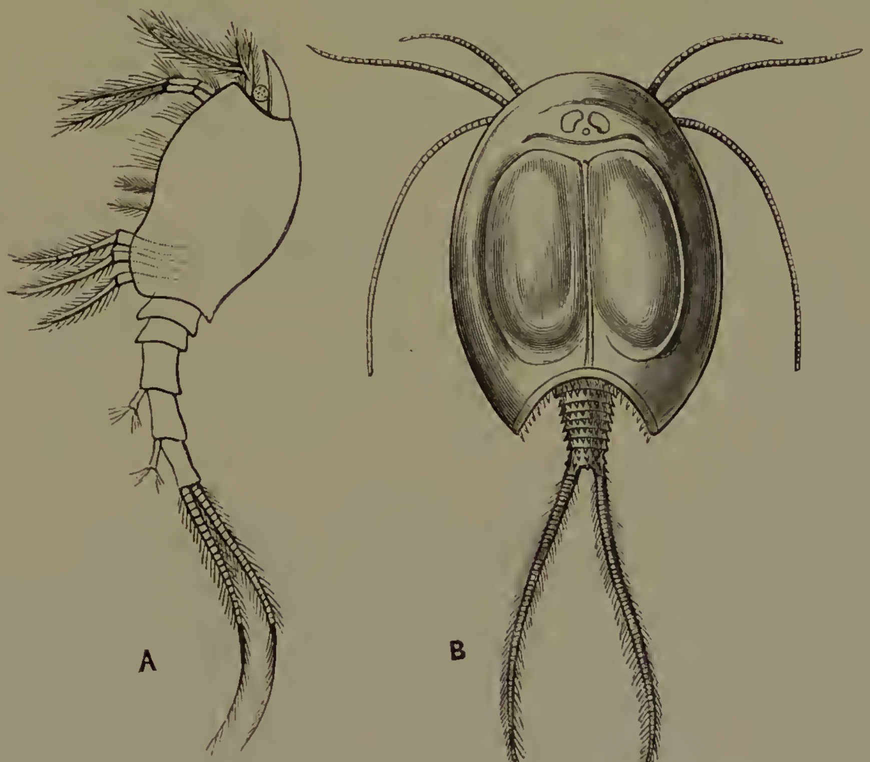

Fig. 48.– Phyllopoda. A, *Nebalia Herbstii*, enlarged about three times. B, *Apus cancriformis*, viewed from above.

The genus *Nebalia* is a transitional form, which is in many respects intermediate between the Phyllopods and the Stomapods. By its development it would appear to be referable rather to the *Malacostraca* than to the *Entomostraca*, in which case it must be placed in or near the order of the *Stomapoda.*

(Claus, *Beiträge zur Kenntniss der Entomostraken,* Marburg, 1860; Grube, *Ueber die Gattungen Estheria und Limnadia und einen neuen Apus,* Archiv für Naturg., 1865.)

ORDER V.—*Trilobita.—*Asaphus, Calymene, Illænus* (fig. 49), *Agnostus, Paradoxides.*

(Barrande, *Système Silurien de la Bohême,* vol. i., 1852 and 1872.)

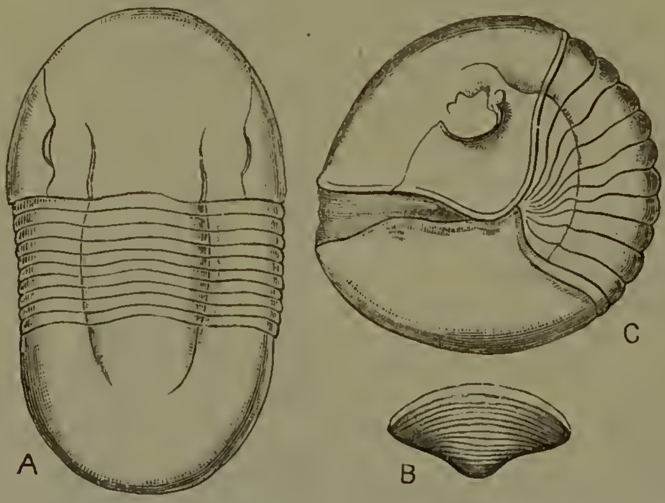

Fig. 49.—A, A complete example of *Illænus Davisii,* in its unrolled state. B, Hypostome of the same. C, *Illænus* (*Bumastus*) *Barriensis,* rolled up. Lower Silurian. (After Salter.)

ORDER VI.—MEROSTOMATA.

Sub-ord. 1. Xiphosura.—*Limulus.*
Sub-ord. 2. *Eurypterida.—*Pterygotus, Slimonia.*

(Owen, *On the Anatomy and Development of the American King Crab,* Trans. Linn. Soc., 1872; Packard, *The Anatomy, Histology, and Embryology of Limulus polyphemus,* Anniversary Mem. of the Boston Soc. Nat. Hist., 1880; Ray Lankester, *Limulus an Arachnid,* Quart. Journ. Micros. Science, 1881; H. Woodward, *Monograph of the Fossil Merostomata,* Palæontographical Society, 1866-72.)

Various authorities at the present day are of opinion that *Limulus* is not properly referable to the *Crustacea*, but that it is a peculiarly modified branchiate type of the *Arachnida*.

SUB-CLASS III.—MALACOSTRACA.

DIVISION A.—EDRIOPHTHALMATA.

ORDER I.—LÆMODIPODA.

Fam. *a*. Caprellidæ.—*Caprella* (fig. 50), *Protella*.
Fam. *b*. Cyamidæ.—*Cyamus*.

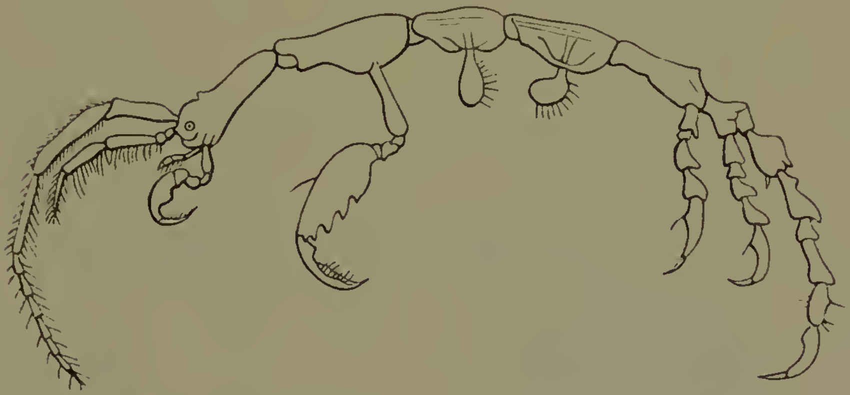

Fig. 50.—Læmodipoda. *Caprella lobata*, enlarged about six times. (After Spence Bate and Westwood.)

The *Læmodipoda* are commonly regarded as a mere section of the *Amphipoda*.

(Spence Bate and Westwood, *History of the British Sessile-eyed Crustacea*, vol. ii., 1868.)

ORDER II.—AMPHIPODA.

Section 1. Gammarinæ.

Fam. *a*. Orchestiidæ.—*Orchestia*, *Talitrus* (Sandhopper, fig. 51).
Fam. *b*. Gammaridæ.—*Gammarus* (Freshwater Shrimp, fig. 51), *Sulcator*, *Kröyera*.
Fam. *c*. Corophiidæ.—*Corophium*.
Fam. *d*. Cheluridæ.—*Chelura*.

Section 2. Hyperinæ.

Fam. *a*. Hyperiidæ.—*Hyperia*.
Fam. *b*. Phronimidæ.—*Phronima*.

(Spence Bate and Westwood, *History of the British Sessile-eyed Crustacea*, 1868; Kröyer, *Grönlands Amphipoder beskrævne*, Kon. Danske Selsk. Naturvid. Afhandlgr., 1836.)

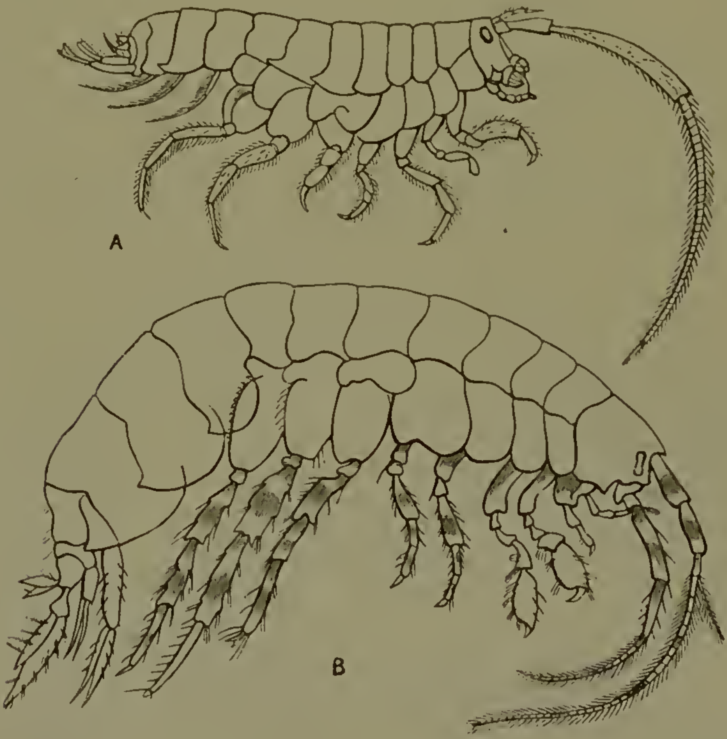

Fig. 51.—Amphipoda. A, *Talitrus locusta*, the "Sandhopper," enlarged. B, *Gammarus locusta*, enlarged about four times. (After Spence Bate and Westwood.)

ORDER III.—ISOPODA.

Section 1. Anisopoda.

Fam. *a.* Tanaidæ.—*Tanais.*
Fam. *b.* Anthuridæ.—*Anthura.*
Fam. *c.* Anceidæ.—*Anceus.*

Section 2. Euisopoda.

Fam. *a.* Cymothoidæ.—*Cymothoa, Æga, Serolis* (fig. 52).
Fam. *b.* Sphæromidæ.—*Sphæroma.*
Fam. *c.* Idoteidæ.—*Idotea* (fig. 52), *Arcturus* (fig. 52).
Fam. *d.* Munnopsidæ.—*Munnopsis.*
Fam. *e.* Asellidæ.—*Asellus, Munna, Limnoria* (Gribble).

Fam. *f.* Bopyridæ.—*Bopyrus, Cryptoniscus.*
Fam. *g.* Oniscidæ.—*Oniscus* (Wood-louse), *Ligia, Armadillo.*

(Spence Bate and Westwood, *History of the British Sessile-eyed Crustacea*, vol. ii., 1868.)

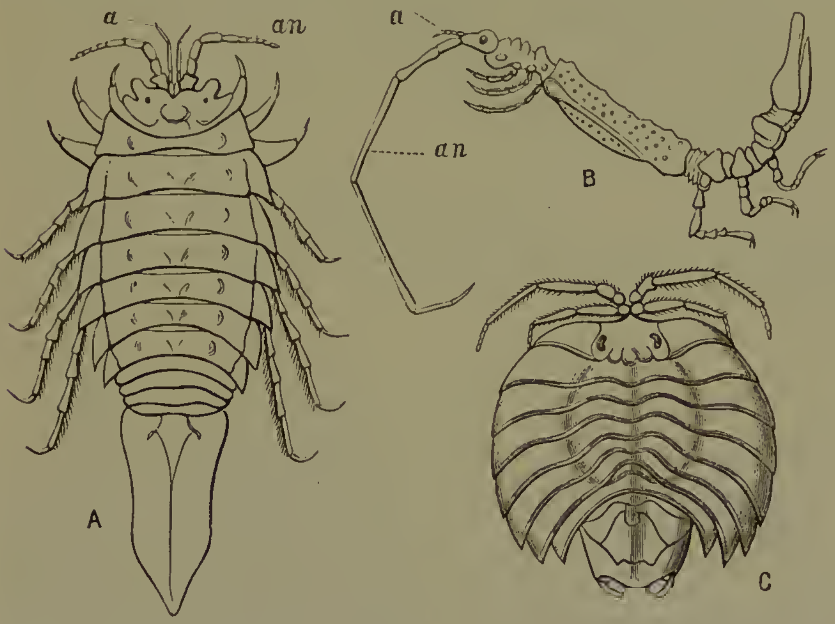

Fig. 52.—Isopoda. A, *Idotea entomon*, enlarged. B, *Arcturus longicornis*, enlarged. C, *Serolis Scythei: a*, Antennæ; *an*, Antennules. (After Gerstæcker, Spence Bate and Westwood, and Lütken.)

DIVISION B.—PODOPHTHALMATA.

ORDER I.—STOMATOPODA or STOMAPODA.

Fam. *a.* Squillidæ.—*Squilla* (Locust-shrimp, fig. 53), *Gonodactylus.*
Fam. *b.* Lophogastridæ.—*Lophogaster.*
Fam. *c.* Euphausiidæ.—*Euphausia.*
Fam. *d.* Mysidæ.—*Mysis* (Opossum-shrimp).
Fam. *e.* Leuciferidæ.—*Leucifer.*

The families *Lophogastridæ*, *Euphausiidæ*, and *Mysidæ* are often regarded as a separate section of the Stalk-eyed Crustaceans, to which the name of *Schizopoda* is given. The *Leuciferidæ*, also, are often looked upon as a family of the Macrurous Decapods.

ORDER II.—DECAPODA.

Tribe 1. Macrura.

Fam. *a.* Diastylidæ.—*Diastylis* (= *Cuma*).
Fam. *b.* Penæidæ.—*Penæus.*
Fam. *c.* Carididæ.—*Palæmon* (Prawn), *Pandalus, Hippolyte, Alpheus, Crangon* (Shrimp).
Fam. *d.* Astacidæ.—*Astacus* (Cray-fish), *Homarus* (Lobster), *Nephrops* (Norway Lobster).
Fam. *e.* Palinuridæ.—*Scyllarus, Palinurus* (Spiny Lobster), **Eryon.*
Fam. *f.* Thalassinidæ.—*Calianassa, Thalassina.*

The family *Diastylidæ* is often regarded as a special subdivision of the *Crustacea,* under the name of the *Cumacea.*

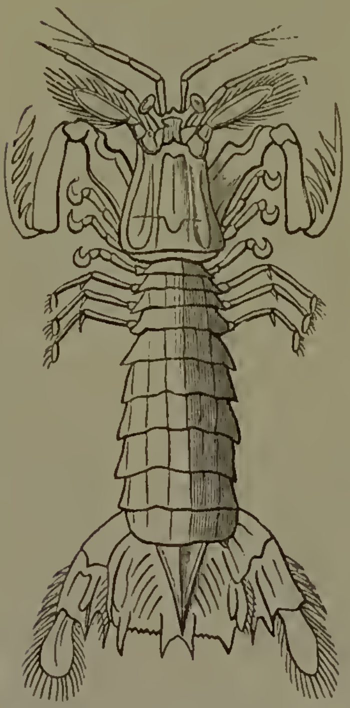

Fig. 53.—*Squilla mantis*, the Locust Shrimp.

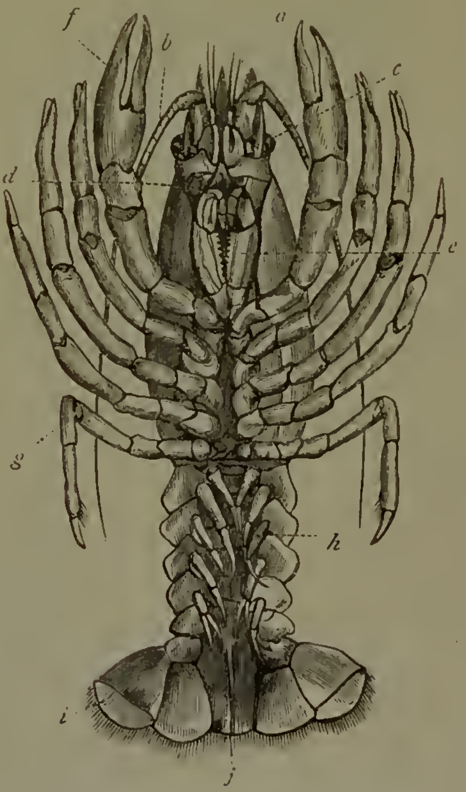

Fig. 54.—The Common Cray-fish (*Astacus fluviatilis*), viewed from below: *a*, Antennules; *b*, Large antennæ; *c*, Eyes; *d*, Opening of antennary gland; *e*, Last pair of foot-jaws; *f*, One of the great chelæ; *g*, Fifth thoracic limbs; *h*, Swimmerets; *i*, The last pair of swimmerets; *j*. The opening of the anus below the telson.

Tribe 2. Anomura.

Fam. *a.* Galatheidæ.—*Galathea.*
Fam. *b.* Paguridæ.—*Pagurus* (Hermit-crabs), *Cœnobita, Birgus.*
Fam. *c.* Porcellanidæ.—*Porcellana.*
Fam. *d.* Hippidæ.—*Hippa.*
Fam. *e.* Lithodidæ.—*Lithodes* (Stone-crabs).

Tribe 3. Brachyura.

Fam. *a.* Raninidæ.—*Ranina.*
Fam. *b.* Leucosiadæ.—*Leucosia.*
Fam. *c.* Calappidæ.—*Calappa.*
Fam. *d.* Maiidæ.—*Inachus, Maia, Stenorhynchus, Hyas* (Spider-crabs).
Fam. *e.* Cancridæ.—*Cancer, Carpilius.*
Fam. *f.* Eriphidæ.—*Pilumnus.*
Fam. *g.* Portunidæ.—*Portunus, Carcinus* (Shore-crabs).
Fam. *h.* Corystidæ.—*Corystes.*
Fam. *i.* Telphusidæ.—*Telphusa.*
Fam. *j.* Pinnotheridæ.—*Pinnotheres.*
Fam. *k.* Gonoplacidæ.—*Gonoplax.*
Fam. *l.* Ocypodidæ.—*Ocypoda* (Sand-crabs).
Fam. *m.* Grapsidæ.—*Grapsus.*
Fam. *n.* Gecarcinidæ.—*Gecarcinus* (Land-crabs).

(Milne-Edwards, *Histoire Naturelle des Crustacés*, Paris, 1834-40; Dana, *Crustacea of the United States Exploring Expedition under Captain Charles Wilkes*, Philadelphia, 1852; Fritz Müller, *Für Darwin*, Leipzig, 1864 (Trans. by W. S. Dallas, "*Facts and Arguments for Darwin*," London, 1869); Leach, *Malacostraca podophthalma Britanniæ*, London, 1817-21; Bell, *History of the British Stalk-eyed Crustacea*, London, 1853.)

CLASS II.—ARACHNIDA.

ORDER I.—PANTOPODA or PODOSOMATA (Sea-spiders).

Fam. *a.* Nymphonidæ.—*Nymphon* (fig. 55).
Fam. *b.* Colossendeidæ.—*Colossendeus.*

Fam. *c.* Pallenidæ.—*Pallene.*

Fam. *d.* Phoxichilidæ.—*Pycnogonum, Phoxichilus.*

(Hoek, *Report on the Pycnogonida,* Report of the Scientific Results of the Exploring Voyage of H.M.S. Challenger, vol. iii., 1881 ; Dohrn, *Neue Untersuchungen über Pycnogoniden,* Mitth. Zool. Stat. Neapel., i. 1879.)

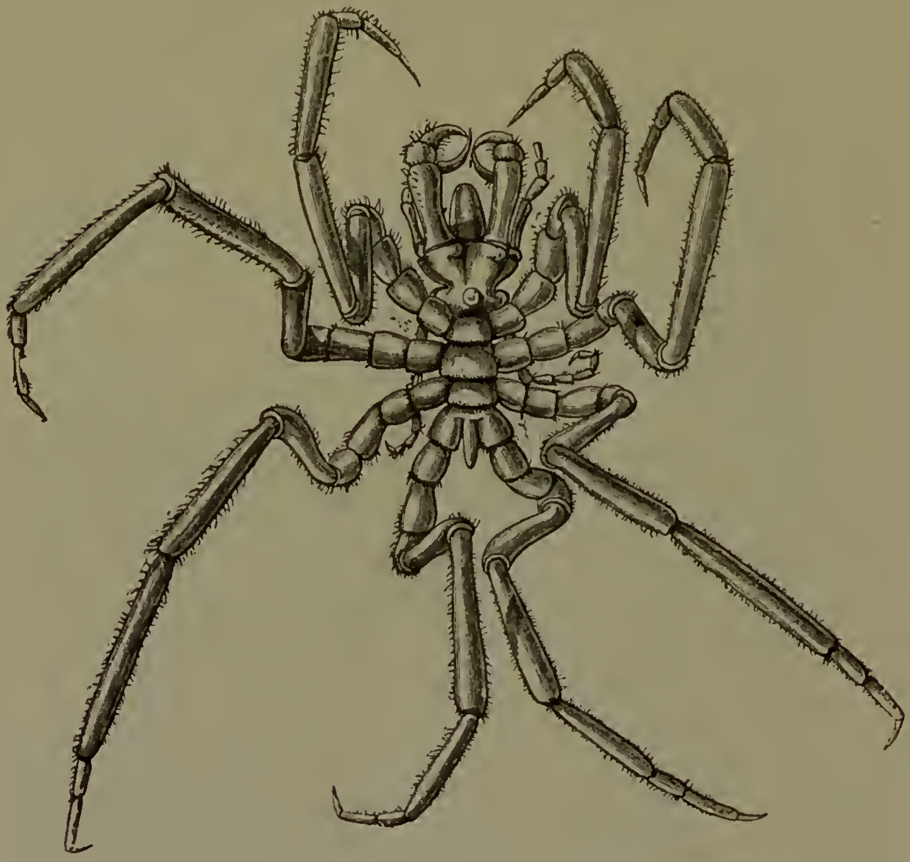

Fig. 55.—Pantopoda. *Nymphon abyssorum,* slightly enlarged. (After Sir Wyville Thomson.)

ORDER II.—ACARINA (MONOMEROSOMATA).

Sub-ord. 1. Pentastomida (Linguatulina).

Fam. Pentastomidæ.—*Pentastoma.*

Sub-ord. 2. Tardigrada (Bear-animalcules).

Fam. Macrobiotidæ.—*Macrobiotus, Emydium.*

Sub-ord. 3. Acarida.

Fam. *a.* Dermatophilidæ.—*Demodex.*
Fam. *b.* Sarcoptidæ.—*Sarcoptes* (Itch-mite).
Fam. *c.* Acaridæ.—*Acarus.*
Fam. *d.* Gamasidæ.—*Gamasus.*
Fam. *e.* Ixodidæ.—*Ixodes* (Tick).
Fam. *f.* Trombididæ.—*Tetranychus.*
Fam. *g.* Hydrachnidæ.—*Limnochares,Hydrachna* (Water-mites).
Fam. *h.* Oribatidæ.—*Oribates.*
Fam. *i.* Bdellidæ.—*Bdella.*

(Leuckart, *Bau und Entwickelungsgeschichte der Pentastomen*, Leipzig, 1860 ; Doyère, *Mémoire sur les Tardigrades*, Ann. des sciences nat., 1840 ; Nicolet, *Histoire naturelle des Acariens,* Archives du Mus., 1855 ; Claparède, *Studien über die Acariden,* Leipzig, 1868 ; Pagenstecher, *Beiträge zur Anatomie der Milben,* Leipzig, 1860-61.)

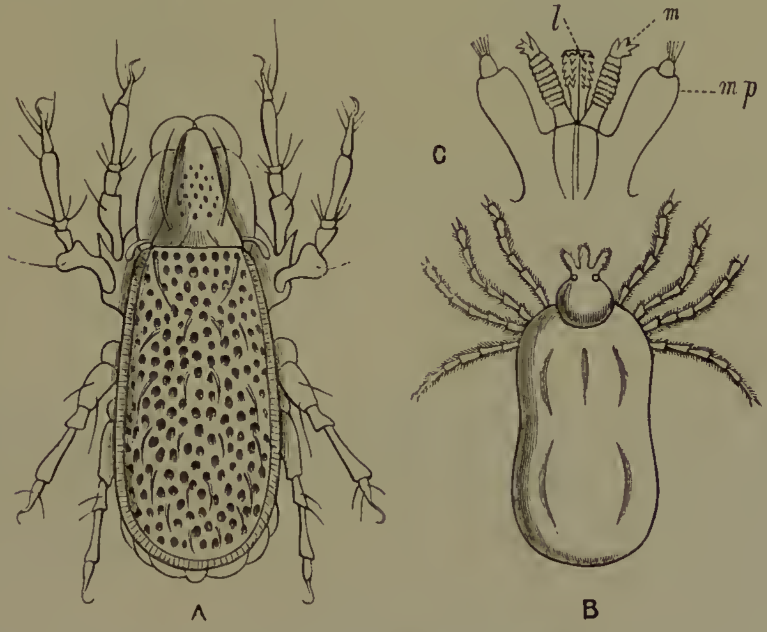

Fig. 56.—Acarina. A, *Tegeocranus elongatus*, enlarged 65 times. B, *Ixodes ricinus*, one of the Ticks, greatly enlarged. C, Mouth-organs of a Tick (*Ixodes albipictus*), enlarged ; *l*, Labium ; *m*, Mandibles ; *mp*, Maxillary palpi. (After Michael, Packard, and Cuvier.)

ORDER III.—ADELARTHROSOMATA.

Sub-ord. 1. Phalangidea.

Fam. *a.* Phalangiidæ.—*Phalangium* (Harvest-men),*Opilio.*

Sub-ord. 2. Pseudoscorpionidæ.

Fam. *a.* Cheliferidæ.—*Chelifer* (Book-scorpions, fig. 57), *Chernes.*
Fam. *b.* Obisiidæ.—*Obisium.*

Sub-ord. 3. Solpugidea (Solifuga).

Fam. Galeodidæ.—*Galeodes* (fig. 57).

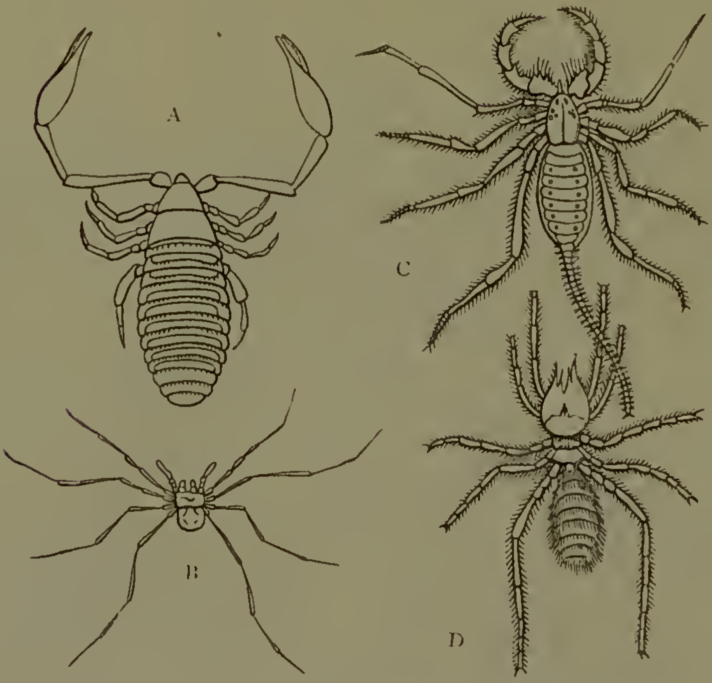

Fig. 57.—A, *Chelifer cancroides*, showing the chelate maxillary palpi, considerably enlarged. B, *Phalangium copticum*, of the natural size. C, *Thelyphonus giganteus*. D, *Galeodes araneoides*, of the natural size.

Order IV.—Pedipalpi.

Sub-ord. 1. Scorpiodea (Scorpions).

Fam. *a.* Scorpionidæ.—*Scorpio* (fig. 58).
Fam. *b.* Androctonidæ.—*Androctonus, Buthus.*

Sub-ord. 2. Phrynidea.

Fam. *a.* Phrynidæ.—*Phrynus.*
Fam. *b.* Thelyphonidæ.—*Thelyphonus* (fig. 57).

(Meade, *Monograph of the British Species of Phalangium*, Ann. Nat. Hist., 1845; Dufour, *Histoire anatomique et physiologique des Scorpions*, 1856; Metschnikoff, *Embryologie des Scorpions*, Leipzig, 1870; Walckenaer and Gervais, *Histoire naturelle des Insectes aptères*, Paris, 1837-44; Packard, *Guide to the Study of Insects*, Boston, 1878.)

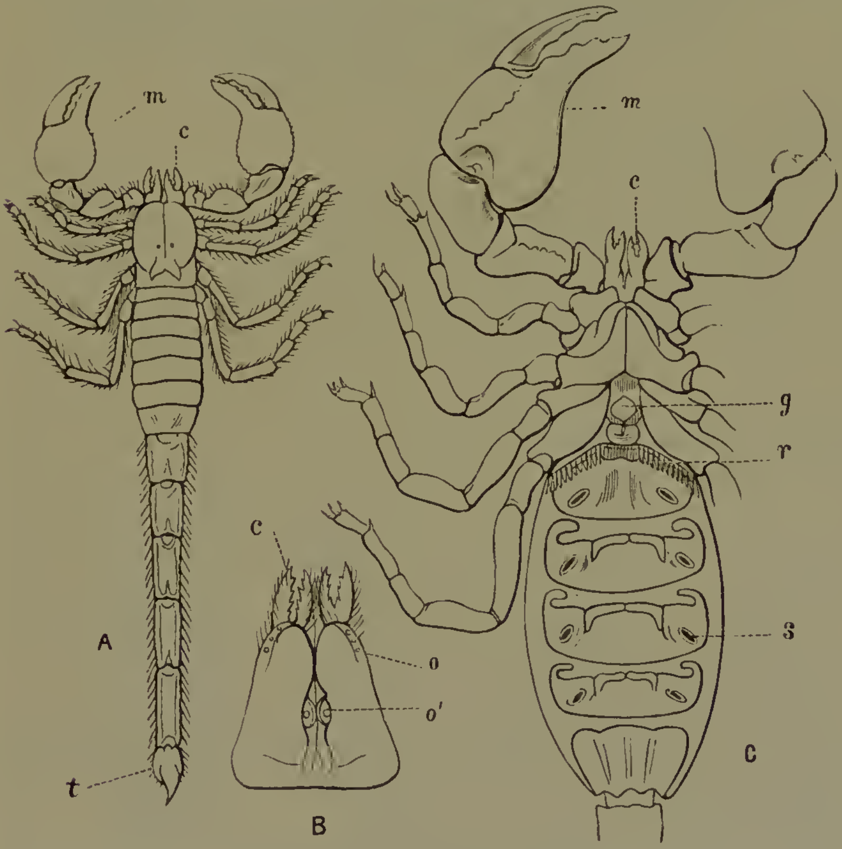

Fig. 58.—Pedipalpi. A, *Scorpio afer*, viewed from above, and somewhat reduced in size. B, Front portion of the head of the same, viewed from above, and enlarged. C, *Buthus Kochii*, with the terminal segments and the ends of the appendages on one side omitted. *m*, Maxillary palpi (behind these are the four pairs of ambulatory legs); *c*, Cheliceræ; *t*, Telson; *o*, Lateral ocelli; *o'*, Central, larger ocelli; *g*, Opercular plate, covering the opening of the reproductive organs; *r*, One of the "combs;" *s*, One of the stigmatic openings. (C is after Prof. Ray Lankester.)

Order V.—Araneida (Spiders).

Sub-ord. 1. Tetrapneumones.
Fam. Mygalidæ.—*Mygale*.

Sub-ord. 2. Dipneumones.
Section 1. Vagabunda.—*Salticus*, *Lycosa*.

Section 2. Sedentaria.—*Thomisus, Drassus, Tegenaria, Theridium, Epeira.*

(Cambridge, Art. "*Arachnida,*" Encyclo. Brit., 9th ed., vol. i., 1875; Blackwall, *History of the Spiders of Great Britain and Ireland,* Ray Soc., 1861-64; Staveley, *British Spiders,* 1866.)

CLASS III.—MYRIAPODA.

ORDER I.—CHILOPODA (Centipedes).

Fam. *a.* Geophilidæ.—*Geophilus.*
Fam. *b.* Lithobiidæ.—*Lithobius.*
Fam. *c.* Scolopendridæ.—*Scolopendra.*
Fam. *d.* Scutigeridæ.—*Scutigera.*
Fam. *e.* *Euphoberiidæ.—*Euphoberia.*

ORDER II.—CHILOGNATHA (Millepedes).

Fam. *a.* Glomeridæ.—*Glomeris* (Pill-millepedes).
Fam. *b.* Polyzoniidæ.—*Polyzonium.*
Fam. *c.* Polydesmidæ.—*Polydesmus.*
Fam. *d.* Polyxenidæ.—*Polyxenus.*
Fam. *e.* Iulidæ.—*Iulus* (fig. 59).
Fam. *d.* *Archiulidæ.—*Archiulus.*

(Newport, *Monograph of the Order Myriapoda, Class Chilopoda,* Linn. Trans., 1843-45; Gervais, *Études pour servir à l'histoire naturelle des Myriapodes,* Ann. des sciences nat., 1857.)

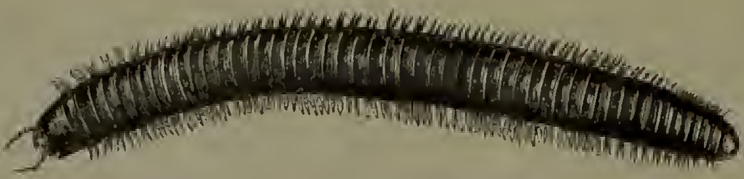

Fig. 59.—Millepede (*Iulus maximus*), a small example, of the natural size.

ORDER III.—PAUROPODA.—*Pauropus.*

(Sir John Lubbock, *On Pauropus, a New Type of Centipede,* Linn. Trans., 1868.)

ORDER IV.—ONYCHOPODA (Onychophora).—*Peripatus* (fig. 60).

(Grube, *Ueber den Bau von Peripatus Edwardsii*, Archiv für Anat., 1853; Moseley, *On the Structure and Development of Peripatus Capensis*, Proc. Roy. Soc., and Ann. Nat. Hist., 1874.)

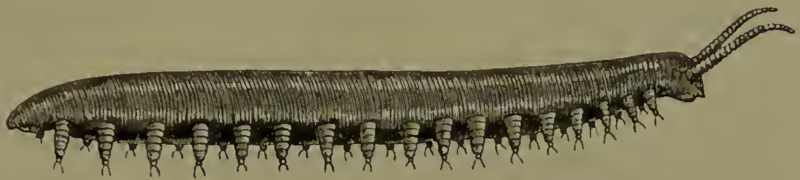

Fig. 60.—Onychopoda. *Peripatus Capensis.* (After Moseley.)

CLASS IV.—INSECTA.

SUB-CLASS I.—AMETABOLA (Aptera).

ORDER I.—ANOPLURA.

Fam. *a.* Pediculidæ (Lice).—*Pediculus, Phthirius.*

ORDER II.—MALLOPHAGA (Bird-lice).—*Trichodectes, Docophorus* (fig. 61).

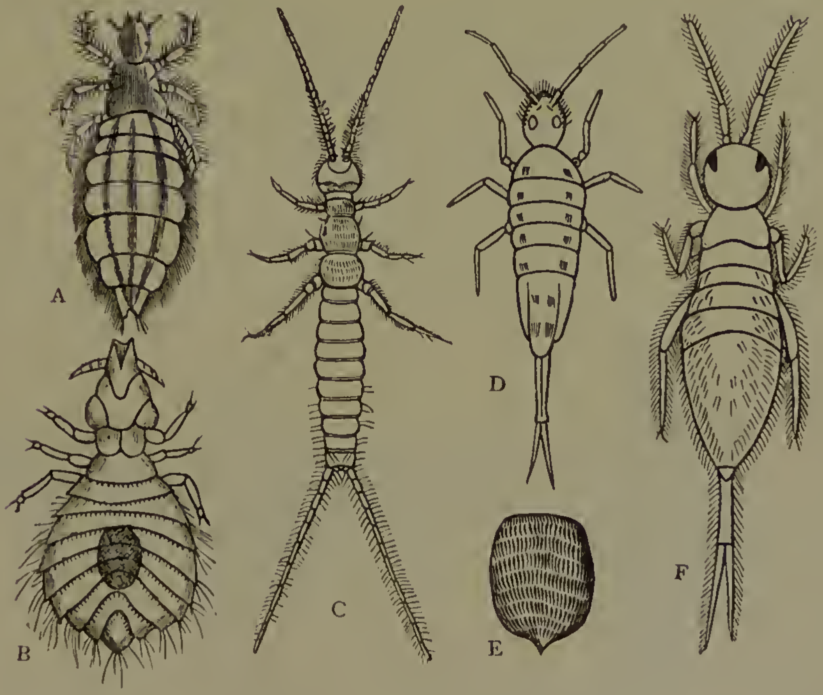

Fig. 61.—Morphology of Aptera. A, *Pediculus humanus capitis*; B, *Docophorus hamatus*, one of the Bird-lice; C, *Campodea*; D, *Degeeria*, one of the *Poduridæ*; E, Scale of a Podurid, as seen under the microscope; F, *Degeeria purpurascens*. All the figures are greatly enlarged. (After Packard and Gervais.)

ORDER III.—COLLEMBOLA.—*Smynthurus, Degeeria* (fig. 61), *Podura.*

ORDER IV.—THYSANURA. — *Campodea* (fig. 61), *Lepisma, Machilis.*

SUB-CLASS II.—HEMIMETABOLA.

ORDER I.—HEMIPTERA.

Sub-ord. 1. Homoptera.

Fam. *a.* Cercopidæ.—*Aphrophora.*
Fam. *b.* Fulgoridæ.—*Fulgora* (Lantern-fly).
Fam. *c.* Cicadidæ.—*Cicada.*
Fam. *d.* Coccidæ (Scale Insects).—*Coccus, Lecanium.*
Fam. *e.* Aphididæ (Plant-lice).—*Aphis, Chermes, Phylloxera.*

Sub-ord. 2. Heteroptera.

Fam. *a.* Notonectidæ.—*Notonecta* (Boat-flies), *Corixa.*
Fam. *b.* Nepidæ.—*Nepa* (Water-scorpions).
Fam. *c.* Gerridæ.—*Gerris, Halobates.*
Fam. *d.* Hydrometridæ.—*Hydrometra.*
Fam. *e.* Reduviidæ.—*Reduvius.*
Fam. *f.* Capsidæ.—*Capsus.*

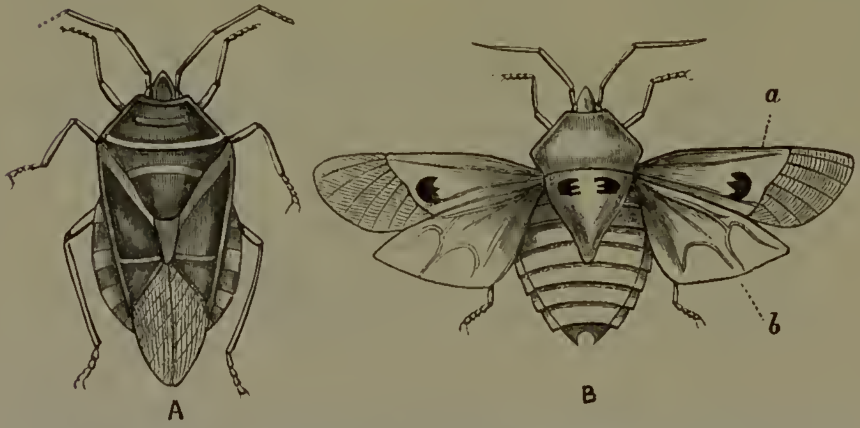

Fig. 62.—Hemiptera. A, *Pentatoma rutilans*, with the wings closed. B, *Rhaphigaster incarnatus*, with the wings expanded in flight: *a*, Anterior wing (hemelytron), with its basal portion hardened by chitine; *b*, Posterior membranous wing.

Fam. *g.* Pentatomidæ.—*Pentatoma* (Field-bugs), *Rhaphigaster* (fig. 62).

Fam. *h.* Scutelleridæ.—*Scutellera.*

Sub-ord. 3. Thysanoptera.

Fam. Thripidæ.—*Thrips.*

ORDER II.—ORTHOPTERA.

Sub-ord. 1. Cursoria.

Fam. Blattidæ (Cockroaches). — *Blatta, Periplaneta* (fig. 63).

Sub-ord. 2. Gressoria.

Fam. *a.* Mantidæ.—*Mantis.*

Fam. *b.* Phasmidæ. — *Phasma, Phyllium* (Walking-leaves).

Sub-ord. 3. Saltatoria.

Fam. *a.* Gryllidæ.—*Gryllotalpa* (Mole-cricket), *Gryllus* (Cricket).

Fam. *b.* Locustidæ.—*Locusta.*

Fam. *c.* Acrididæ.—*Œdipoda* (Migratory Locust), *Acridium* (Grasshopper).

Sub-ord. 4. Euplexoptera.

Fam. Forficulidæ.—*Forficula* (Earwig).

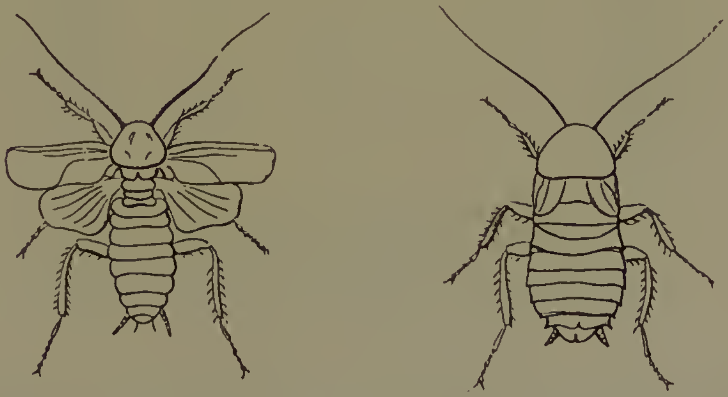

Fig. 63.—Orthoptera. The Common Cockroach (*Periplaneta orientalis*), male and female.

Order III.—Neuroptera.

Sub-ord. 1. Corrodentia.

Fam. *a.* Psocidæ.—*Psocus.*
Fam. *b.* Embiidæ.—*Embia.*

Sub-ord. 2. Isoptera.

Fam. Termitidæ.—*Termes* (White Ants, fig. 64).

Sub-ord. 3. Amphibiotica.

Fam. *a.* Perlidæ.—*Perla* (Stone-flies).
Fam. *b.* Ephemeridæ.—*Ephemera* (May-flies), *Chloëon.*

Sub-ord. 4. Odonata (Dragon-flies).

Fam. *a.* Libellulidæ.—*Libellula.*
Fam. *b.* Æshnidæ.—*Æshna.*
Fam. *c.* Agrionidæ.—*Agrion.*

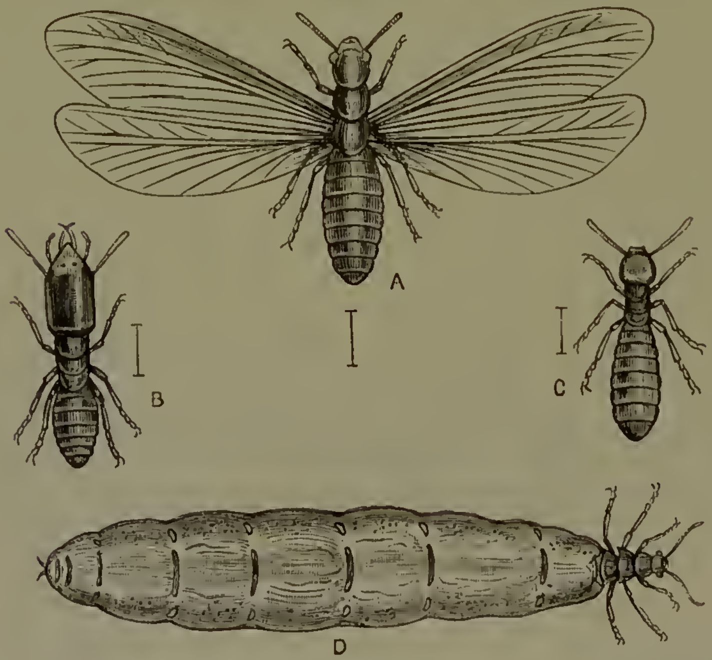

Fig. 64.—Different individuals of the colony of one of the Termites. A, The queen, before the wings are shed; D, The queen, after the wings are thrown off and the abdomen has become greatly distended with eggs; C, Worker; B, Soldier.

Sub-ord. 5. Planipennia.

Fam. *a.* Myrmeleontidæ.—*Myrmeleo* (Ant-lion).
Fam. *b.* Hemerobiidæ.—*Chrysopa.*
Fam. *c.* Sialidæ.—*Corydalis.*
Fam. *d.* Panorpidæ.—*Panorpa* (Scorpion-fly).

Sub-ord. 6. Trichoptera (Caddis-flies).—*Phryganea, Limnophilus.*

SUB-CLASS III.—HOLOMETABOLA.

ORDER I.—APHANIPTERA.

Fam. Pulicidæ.—*Pulex* (Flea), *Sarcopsylla* (Chigoe).

ORDER II.—DIPTERA.

Sub-ord. 1. Pupipara.

Fam. *a.* Hippoboscidæ.—*Hippobosca* (Forest-fly), *Melophagus* (Sheep-tick).
Fam. *b.* Nycteribiidæ.—*Nycteribia.*

Sub-ord. 2. Brachycera.

Fam. *a.* Tabanidæ.—*Tabanus* (Gad-fly).
Fam. *b.* Asilidæ.—*Asilus.*
Fam. *c.* Syrphidæ.—*Syrphus, Volucella.*
Fam. *d.* Œstridæ.—*Œstrus* (Bot-fly).
Fam. *e.* Muscidæ.—*Musca, Stomoxys, Anthomyia.*

Sub-ord. 3. Nemocera.

Fam. *a.* Tipulidæ.—*Tipula.*
Fam. *b.* Cecidomyiidæ.—*Cecidomyia* (Hessian Fly).
Fam. *c.* Chironomidæ.—*Corethra.*
Fam. *d.* Culicidæ.—*Culex* (Gnat, fig. 65).

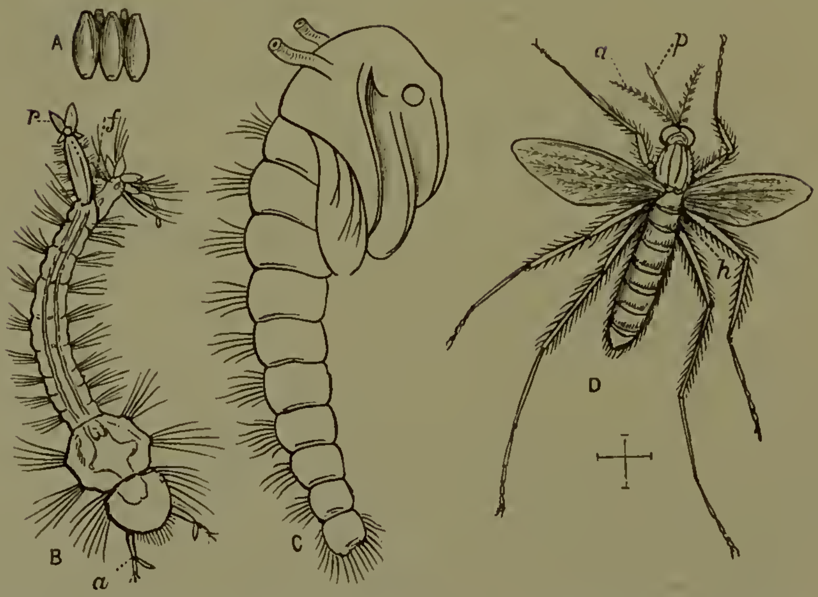

Fig. 65.—The common Gnat (*Culex pipiens*). A, A few of the eggs, attached together to form a raft, which floats on the water; B, The larva, suspended in the water head downwards, and showing the antennæ (*a*), the terminal respiratory tube (*r*), and the fins attached to the extremity of the body (*f*); C, The pupa, with the two respiratory tubes attached to the thorax; D, The adult insect, with the well-developed front wings, the rudimentary hind wings or "balancers" (*h*), the antennæ (*a*), and the proboscis (*p*). All the figures are greatly enlarged.

ORDER III.—LEPIDOPTERA.

Section 1. Heterocera (Moths).

Fam. *a.* Tineidæ.—*Tinea.*
Fam. *b.* Tortricidæ.—*Tortrix.*
Fam. *c.* Geometridæ.—*Geometra.*
Fam. *d.* Noctuidæ.—*Noctua.*
Fam. *e.* Bombycidæ.—*Bombyx.*
Fam. *f.* Sphingidæ.—*Sphinx.*

Section 2. Rhopalocera (Butterflies).

Fam. *a.* Hesperiidæ.—*Hesperia.*
Fam. *b.* Lycænidæ.—*Thecla, Lycæna.*
Fam. *c.* Erycinidæ.—*Erycina.*
Fam. *d.* Nymphalidæ.—*Vanessa, Nymphalis.*
Fam. *e.* Papilionidæ.—*Colias, Papilio.*

ORDER IV.—HYMENOPTERA.

Sub-ord. 1. Terebrantia.

Fam. *a.* Tenthredinidæ.—*Tenthredo* (Saw-fly).
Fam. *b.* Siricidæ.—*Sirex.*

Sub-ord. 2. Pupivora.

Fam. *a.* Cynipidæ (Gall-flies).—*Cynips.*
Fam. *b.* Chalcididæ.—*Chalcis.*
Fam. *c.* Ichneumonidæ.—*Ichneumon.*

Sub-ord. 3. Aculeata.

Fam. *a.* Formicidæ (Ants).—*Formica, Polyergus, Ponera.*
Fam. *b.* Vespidæ (Wasps).—*Vespa.*
Fam. *c.* Crabronidæ (Hornets).—*Crabro.*
Fam. *d.* Apidæ (Bees).—*Apis, Bombus.*
Fam. *e.* Andrenidæ.—*Andrena.*

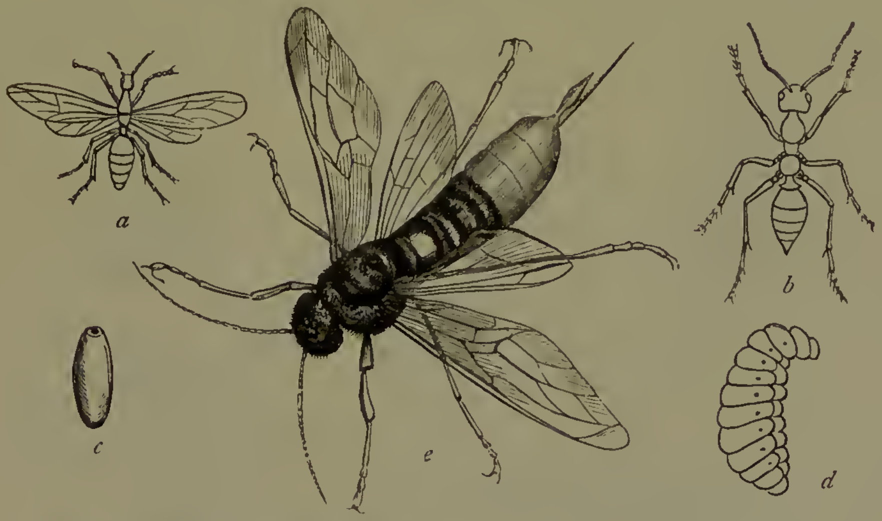

Fig. 66.—Hymenoptera. *a*, Winged male of Ant; *b*, Wingless worker of Ant; *c*, Pupa of Ant; *d*, Larva of Ant, enlarged; *e*, The Great Saw-fly (*Sirex gigas*).

ORDER V.—STREPSIPTERA.

Fam. Stylopidæ.—*Stylops.*

ORDER VI.—COLEOPTERA (Beetles).

Sub-ord. 1. Trimera.

Fam. Coccinellidæ (Lady-birds).—*Coccinella.*

Sub-ord. 2. Tetramera.

Families: Halticidæ, Chrysomelidæ, Lamiidæ, Prionidæ (Longicorn Beetles), Curculionidæ (Weevils).

Sub-ord. 3. Heteromera.

Families: Cantharidæ, Meloidæ, Rhiphiphoridæ, Tenebrionidæ.

Sub-ord. 4. Pentamera.

Families: Telephoridæ, Elateridæ, Buprestidæ, Scarabæidæ, Lucanidæ, Silphidæ, Staphylinidæ, Hydrophilidæ, Dytiscidæ, Carabidæ, Cicindelidæ.

(Westwood, *Introduction to the Modern Classification of Insects*, 1839-40; Kirby and Spence, *Introduction to Entomology*, 1828; Burmeister, *Handbuch der Entomologie*, 1832-47; Packard, *Guide to the Study of Insects*, 6th ed., 1878.)[1]

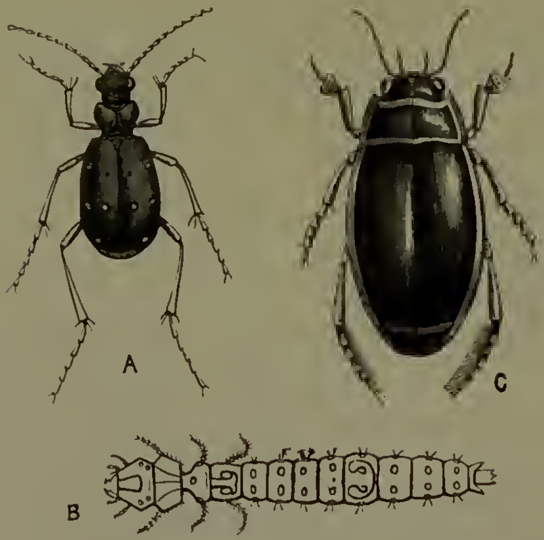

Fig. 67.—Coleoptera. A, *Cicindela campestris*, the Tiger-beetle, enlarged. B, Larva of the same, enlarged. C, *Dytiscus marginalis*, male.

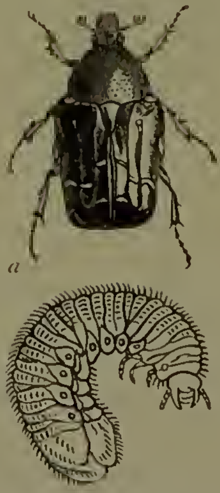

Fig. 68.—*a*, Rose-chafer (*Cetonia aurata*) and larva.

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[1] Only the more important families of the larger orders of insects are mentioned above.

SUB-KINGDOM (TYPE) V.—MOLLUSCA.

Soft-bodied, unsegmented animals, usually provided with an exoskeleton. Alimentary canal shut off from the body-cavity. Nervous system in the form of three principal pairs of ganglia, which are reduced to one in the lower types. A distinct heart, and specialised organs of respiration, may or may not be present. Distinct reproductive organs are present in all, though among the lower forms of the sub-kingdom the production of colonial organisms by continuous gemmation is not uncommon.

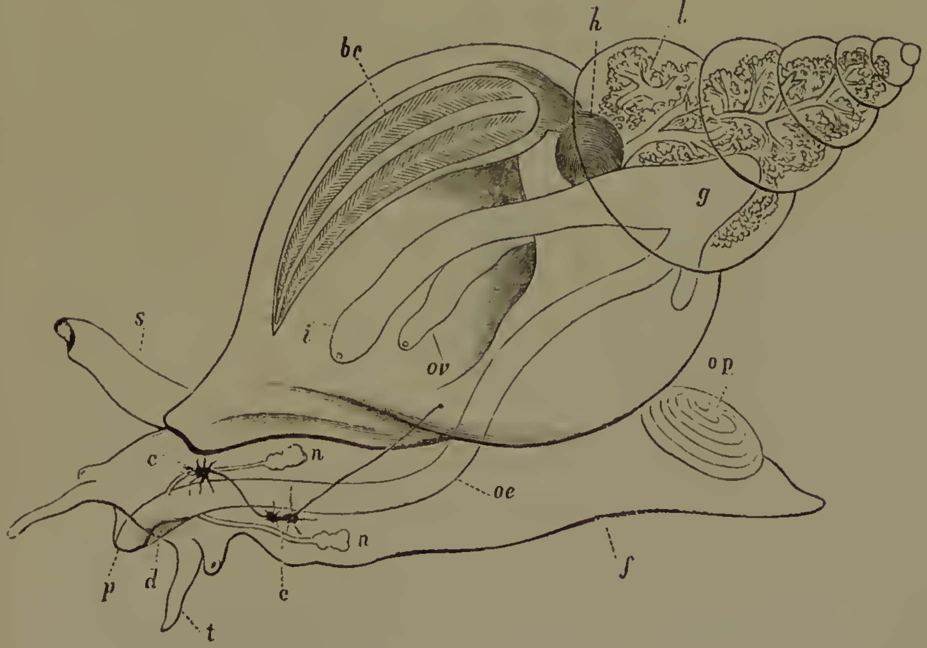

Fig. 69.—Diagram of the structure of a typical Mollusc (the Common Whelk) *f*, The muscular "foot;" *op*, The operculum; *t*, One of the tentacles, or feelers, with an eye at its base; *p*, The proboscis, retracted, with the mouth at its extremity; *oe*, Gullet; *g*, Stomach; *i*, Intestine, terminating in the anus; *n n*, Salivary glands; *l*, The liver and the ovary; *h*, The heart; *bc*, The gill, contained in a hood of the mantle; *s*, Breathing-tube or siphon; c and c, The main nerve ganglia.

DIVISION A.—MOLLUSCOIDA.

CLASS I.—POLYZOA.

SUB-CLASS I.—ECTOPROCTA.

ORDER I.—PHYLACTOLÆMATA.

Fam. *a*. Plumatellidæ (Lophopea).—*Plumatella*, *Lophopus*.
Fam. *b*. Cristatellidæ.—*Cristatella*.

ORDER II.—GYMNOLÆMATA.

Sub-ord. 1. Cheilostomata.

Fam. *a*. Catenicellidæ.—*Catenicella*.
Fam. *b*. Cellariidæ.—*Cellaria*.
Fam. *c*. Cellulariidæ.—*Cellularia*.
Fam. *d*. Scrupariidæ.—*Scruparia*, *Hippothoa*.
Fam. *e*. Gemellariidæ.—*Gemellaria*.
Fam. *f*. Bicellariidæ.—*Bugula*.
Fam. *g*. Flustridæ.—*Flustra* (Sea-mat, fig. 70).
Fam. *h*. Membraniporidæ.—*Membranipora*.
Fam. *i*. Celleporidæ.—*Cellepora*.
Fam. *j*. Escharidæ.—*Eschara*, *Lepralia*.
Fam. *k*. Reteporidæ.—*Retepora*.
Fam. *l*. Vinculariidæ.—*Vincularia*.
Fam. *m*. Selenariidæ.—*Selenaria*.

Sub-ord. 2. Cyclostomata.

Fam. *a*. Crisiidæ.—*Crisia*.
Fam. *b*. Idmoneidæ.—*Idmonea*, *Hornera*.
Fam. *c*. Tubuliporidæ.—*Tubulipora*.
Fam. *d*. Diastoporidæ.—*Diastopora*.
Fam. *e*. Discoporellidæ.—*Discoporella*, *Heteropora*.

Sub-ord. 3. Ctenostomata.

Fam. *a*. Vesiculariidæ.—*Vesicularia*, *Valkeria*.
Fam. *b*. Alcyonidiidæ.—*Alcyonidium*.

SUB-CLASS II.—ENTOPROCTA.

Fam. *a.* Loxosomidæ.—*Loxosoma.*
Fam. *b.* Pedicellinidæ.—*Pedicellina.*

SUB-CLASS III.—ASPIDOPHORA.

Fam. Rhabdopleuridæ.—*Rhabdopleura.*

(Allman, *A Monograph of the Fresh-water Polyzoa,* Ray Society, 1856; Busk, *Catalogue of the Marine Polyzoa in the British Museum,* 1854-76; Nitsche, *Beitrag zur Kenntniss der Bryozoen,* Zeitschr. für Wiss. Zool., 1871; Hincks, *A History of the British Marine Polyzoa,* 1880.)

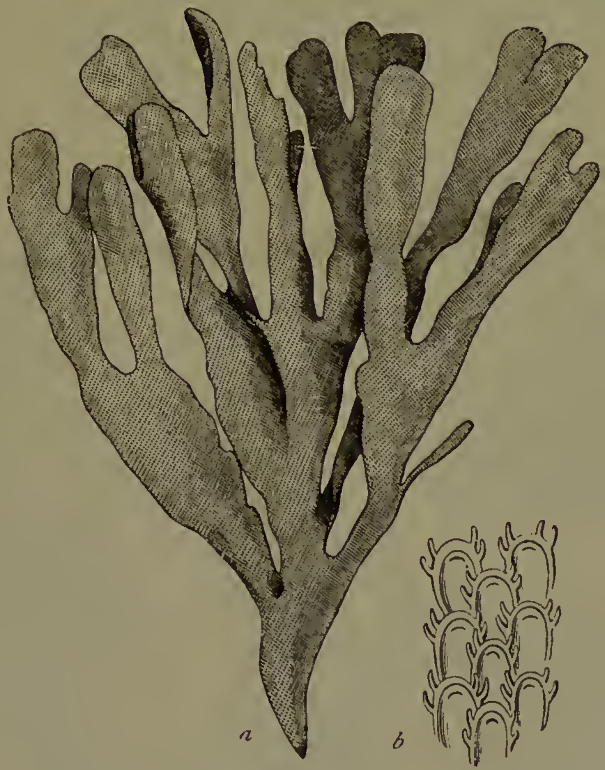

Fig. 70.—*Flustra foliacea,* one of the Sea-mats.

CLASS II.—TUNICATA (Sea-squirts).

ORDER I.—ASCIDIACEA.

Fam. *a.* Appendiculariidæ.—*Appendicularia.*
Fam. *b.* Pelonaiidæ.—*Pelonaia.*
Fam. *c.* Ascidiidæ.—*Ascidia* (fig. 71), *Ciona, Molgula, Cynthia.*
Fam. *d.* Clavellinidæ.—*Clavellina, Perophora.*

Fam. *c.* Botryllidæ. — *Botryllus, Didemnum, Amaroucium.*

Fam. *f.* Pyrosomidæ.—*Pyrosoma.*

Order II.—Thaliacea (Biphora).

Fam. *a.* Salpidæ.—*Salpa.*

Fam. *b.* Doliolidæ.—*Doliolum.*

(Milne-Edwards, *Observations sur les Ascidies composées de côtes de la Manche*, Mém. Acad. Sci. Paris, 1839 ; Huxley, *Upon the Anatomy and Physiology of Salpa and Pyrosoma*, Phil. Trans., 1851 ; Hancock, *Anatomy and Physiology of the Tunicata*, Journ. Linn. Soc., 1868 ; Heller, *Untersuchungen über die Tunicaten des Adriatischen und Mittelmeeres*, 1874-75 : Kowalevsky, *Entwickelungsgeschichte der einfachen Ascidien*, St Petersburg, 1866.)

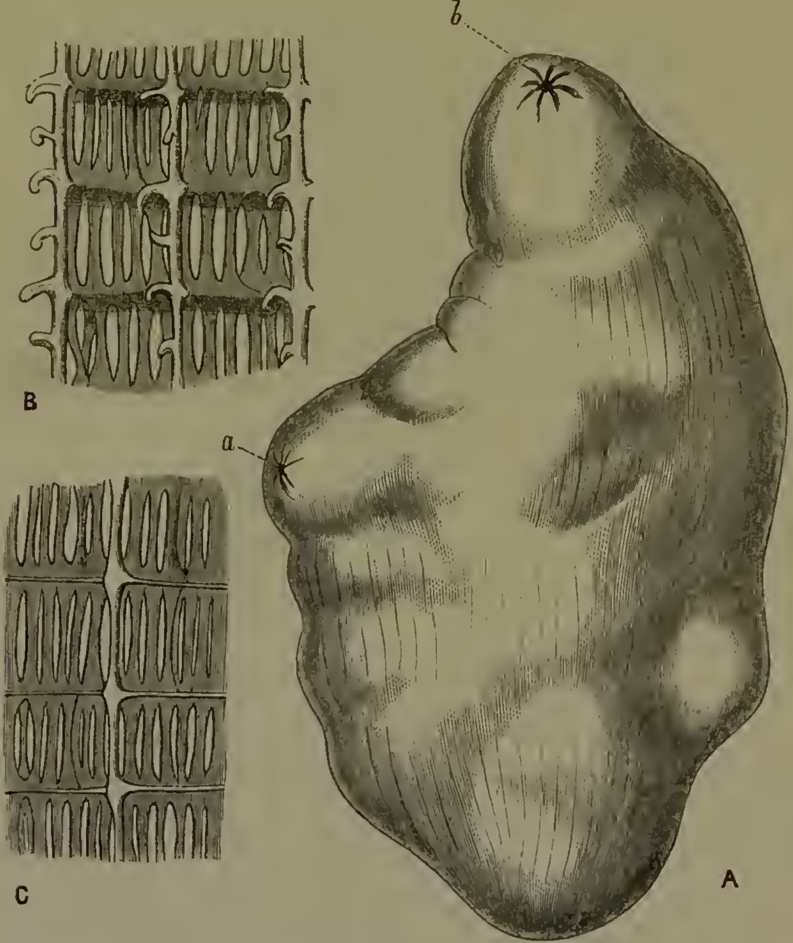

Fig. 71.—Tunicata. A, *Ascidia lata*, seen from the right side, of the natural size : *b*, Branchial aperture ; *a*, Atrial aperture. B, Part of the branchial sac of the same, seen from the inside, magnified. C, Part of the branchial sac of *Ascidia virginea* (= *Ascidia sordida*), seen from the inside, magnified. (After Herdman.)

CLASS III.—BRACHIOPODA.

ORDER I.—INARTICULATA.

Fam. *a.* Lingulidæ.—*Lingula.*
Fam. *b.* Discinidæ.—*Discina.*
Fam. *c.* Craniadæ.—*Crania.*
Fam. *d.* *Trimerellidæ.—*Trimerella.*

ORDER II.—ARTICULATA.

Fam. *a.* Terebratulidæ.—*Terebratula, Argiope.*
Fam. *b.* Thecidiidæ.—*Thecidium.*
Fam. *c.* *Spiriferidæ.—*Spirifera, Athyris.*
Fam. *d.* *Koninckinidæ.—*Koninckina.*
Fam. *e.* Rhynchonellidæ.—*Rhynchonella.*
Fam. *f.* *Pentameridæ.—*Pentamerus.*
Fam. *g.* *Strophomenidæ.—*Strophomena, Orthis.*
Fam. *h.* *Productidæ.—*Producta.*

(Owen, *Anatomy of the Brachiopoda*, Trans. Zool. Soc., 1835; Hancock, *On the Organisation of the Brachiopoda*, Phil. Trans., 1858; Davidson, *Monograph of the British Fossil Brachiopoda*, Palæontographical Soc., 1851-81.)

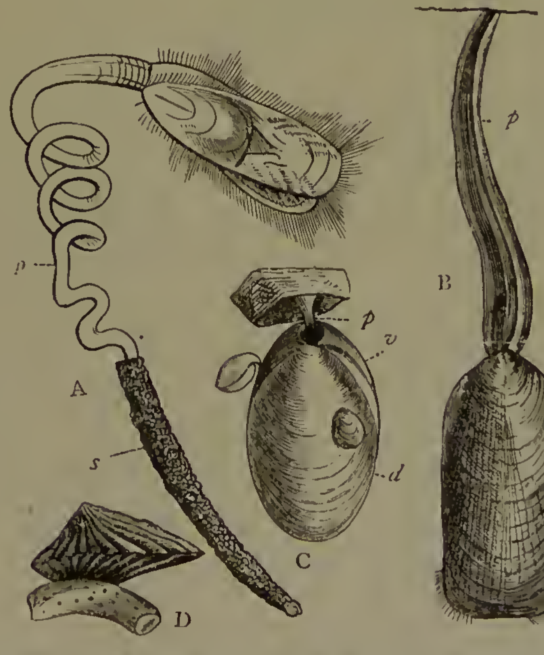

Fig. 72.—Morphology of *Brachiopoda*. A, *Lingula pyramidata* (after Morse): *p*, Peduncle; *s*, Sand-tube, encasing base of peduncle. B, *Lingula anatina* (after Cuvier): *p*, The peduncle. C, *Waldheimia cranium*, with adherent young, attached to a stone (after Davidson): *p*, Peduncle; *v*, Ventral valve; *d*, Dorsal valve. D, *Crania Ignabergensis*, attached by its ventral valve to a piece of coral (Chalk).

There are great difficulties in the way of arriving at any final conclusion as to the systematic position of the three groups of the *Polyzoa, Tunicata,* and *Brachiopoda.* Many high authorities now regard the *Polyzoa* as an aberrant group of worms, related to the true Annelides, the grounds for this conclusion being mainly derived from a study of the developmental history of the *Polyzoa.* Upon similar grounds, many naturalists consider the *Brachiopoda* as also a modified group of the worms. Lastly, the *Tunicata* are often looked upon as a degraded type of the *Vertebrata.*

DIVISION B.—MOLLUSCA PROPER.

CLASS I.—LAMELLIBRANCHIATA (CONCHIFERA).

SUB-CLASS I.—ASIPHONIDA.

ORDER I.—OSTREACEÆ.

Fam. *a.* Anomiadæ.—*Anomia.*
Fam. *b.* Ostreidæ.—*Ostrea,* **Gryphæa.*
Fam. *c.* Placunidæ.—*Placuna.*
Fam. *d.* Pectinidæ.—*Pecten* (Scallop).
Fam. *e.* Limadæ.—*Lima.*
Fam. *f.* Spondylidæ.—*Spondylus.*

ORDER II.—MYTILACEÆ.

Fam. *a.* Aviculidæ.—*Avicula* (Pearl-oyster), *Malleus,* **Inoceramus.*
Fam. *b.* Mytilidæ.—*Mytilus* (Mussel), *Dreissena.*
Fam. *c.* Pinnidæ.—*Pinna.*

ORDER III.—ARCACEÆ.

Fam. *a.* Arcadæ.—*Arca, Pectunculus.*
Fam. *b.* Nuculidæ.—*Nucula.*
Fam. *c.* Nuculanidæ (Ledidæ).—*Nuculana* (*Leda*).
Fam. *d.* Trigoniadæ.—*Trigonia.*

ORDER IV.—UNIONACEÆ.

Fam. Unionidæ.—*Unio, Anodon* (Fresh-water Mussels).

SUB-CLASS II.—SIPHONIDA.

ORDER I.—*RUDISTÆ.

Fam. Hippuritidæ.—*Hippurites.*

ORDER II.—CHAMACEÆ.

Fam. *a.* Chamidæ.—*Chama,* **Diceras.*
Fam. *b.* Tridacnidæ.—*Tridacna, Hippopus.*

ORDER III.—CARDIACEA.

Fam. Cardiidæ.—*Cardium* (Cockle), *Hemicardium.*

ORDER IV.—LUCINACEA.

Fam. *a.* Lucinidæ.—*Lucina, Corbis.*
Fam. *b.* Cyprinidæ.—*Cyprina, Isocardia.*
Fam. *c.* Astartidæ.—*Astarte, Crassatella,* **Cardita.*

ORDER V.—CYCLADACEÆ.

Fam. Cycladidæ.—*Cyclas, Cyrena.*

ORDER VI.—VENERACEÆ.

Fam. Veneridæ.—*Venus, Artemis.*

ORDER VII.—TELLINACEÆ.

Fam. *a.* Tellinidæ.—*Tellina, Donax, Psammobia, Scrobicularia.*
Fam. *b.* Mactridæ.—*Mactra, Lutraria.*

ORDER VIII.—MYACEÆ.

Fam. *a.* Myacidæ.—*Mya, Corbula, Saxicava.*
Fam. *b.* Anatinidæ.—*Anatina, Thracia, Pholadomya.*
Fam. *c.* Solenidæ.—*Solen* (Razor-shell), *Cultellus.*

ORDER IX.—PHOLADACEÆ.

Fam. *a.* Gastrochænidæ.—*Gastrochæna, Aspergillum.*
Fam. *b.* Pholadidæ.—*Pholas, Teredo.*

The ordinal divisions in the above list cannot be regarded as in all cases strictly natural groups, nor can they be considered as precisely equivalent to the "orders" of other classes of animals.

(Bronn, *Malacozoa Acephala*, Die Klassen und Ordnungen des Thierreichs, 1862; S. P. Woodward, *A Manual of the Mollusca*, 3d ed., 1875; Stoliczka, *The Pelecypoda of the Cretaceous Rocks of India*, Palæontologia Indica, 1875.)

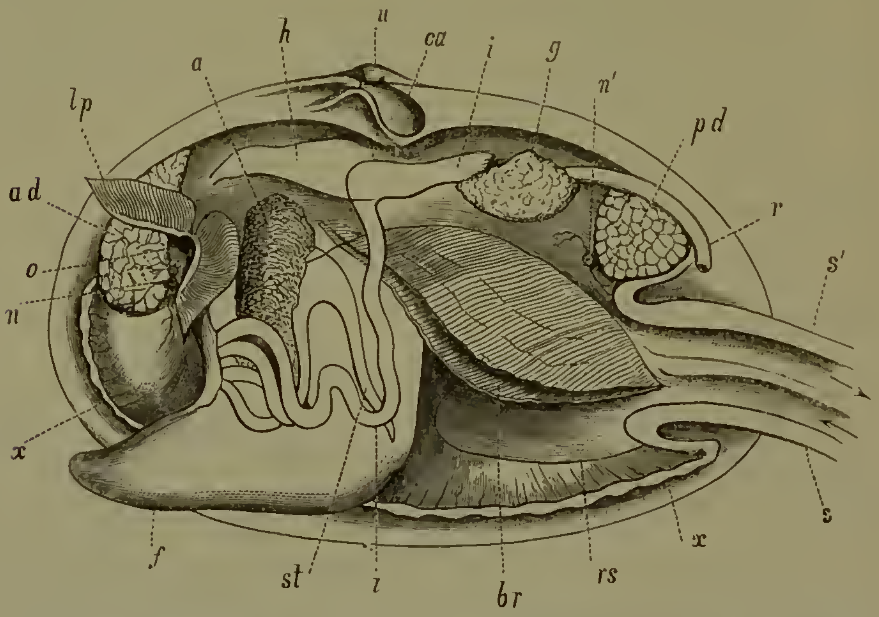

Fig. 73.—Lamellibranchiata. Diagrammatic representation of the anatomy of a siphonate Bivalve. The left valve and left mantle-lobe are removed, and the siphons are cut short. *u*, Umbo; *ca*, Cartilage-pit; *o*, Mouth; *lp*, Labial palpi; *a*, Stomach, surrounded by liver; *st*, Sac containing the crystalline stylet; *i i*, Intestine, perforating the heart (*h*); *r*, Rectum, terminating in the anus; *ad*, Anterior adductor; *pd*, Posterior adductor; *n*, Supra-œsophageal or cerebral ganglion (the mouth is a little displaced upwards, so that the ganglion comes to lie below the gullet instead of above it); *n'*, Parieto-splanchnic or branchial ganglion; *f* Foot; *x x*, Cut edge of the right mantle-lobe; *rs*, Retractor muscle of the siphons; *br*, Branchiæ of the left side; *g*, Generative glands; *s*, Inhalant siphon; *s'*, Exhalant siphon.

CLASS II.—GASTEROPODA.

Sub-class I.—Branchiata.

Order I.—Scaphopoda.

Fam. Dentaliidæ.—*Dentalium*.

Order II.—Prosobranchiata.

Section A. Siphonostomata.

Fam. *a*. Strombidæ.—*Strombus, Pteroceras.*
Fam. *b*. Muricidæ.—*Murex, Fusus.*

Fam. *c.* Buccinidæ.—*Buccinum* (Whelk), *Nassa*, *Purpura*, *Oliva*.
Fam. *d.* Conidæ.—*Conus*, *Pleurotoma*.
Fam. *e.* Volutidæ.—*Voluta*, *Mitra*.
Fam. *f.* Cypræidæ (Cowries).—*Cypræa*, *Ovulum*.

Section B. Holostomata.

Fam. *a.* Naticidæ.—*Natica*, *Sigaretus*.
Fam. *b.* Pyramidellidæ.—*Pyramidella*, *Chemnitzia*.
Fam. *c.* Cerithiadæ.—*Cerithium*, *Aporrhais*.
Fam. *d.* Melaniadæ.—*Melania*.
Fam. *e.* Turritellidæ.—*Turritella*, *Scalaria*, *Vermetus*.
Fam. *f.* Littorinidæ.—*Littorina* (Periwinkle), *Solarium*.
Fam. *g.* Paludindiæ.—*Paludina*, *Ampullaria*.
Fam. *h.* Neritidæ.—*Nerita*.
Fam. *i.* Turbinidæ.—*Turbo*, *Trochus*.
Fam. *j.* Haliotidæ. — *Haliotis* (Ear-shell), *Pleurotomaria*.
Fam. *k.* Fissurellidæ.—*Fissurella* (Keyhole Limpet).
Fam. *l.* Calyptræidæ.—*Calyptræa* (Cup-and-saucer Limpet), *Capulus* (Bonnet Limpet).

Section C. Cyclobranchiata.

Fam. Patellidæ (Limpets).—*Patella*, *Acmæa*.

Section D. Polyplacophora.

Fam. Chitonidæ.—*Chiton*.

ORDER III.—OPISTHOBRANCHIATA.

Section A. Nudibranchiata.

Families:—Doridæ (Sea-lemons), Æolidæ, Dendronotidæ, Tethydidæ.—*Doris*, *Æolis*, *Doto*, *Tethys*.

Section B. Tectibranchiata.

Fam. *a.* Tornatellidæ.—*Tornatella*.
Fam. *b.* Bullidæ.—*Bulla* (Bubble-shells).
Fam. *c.* Aplysiadæ.—*Aplysia* (Sea-hare).
Fam. *d.* Pleurobranchidæ.—*Umbrella*.
Fam. *e.* Runcinidæ.—*Runcina*.

ORDER IV.—HETEROPODA (NUCLEOBRANCHIATA).

Fam. *a.* Firolidæ.—*Firola, Carinaria.*
Fam. *b.* Atlantidæ.—*Atlanta.*

SUB-CLASS II.—PULMONATA.

ORDER I.—INOPERCULATA.

Fam. *a.* Helicidæ.—*Helix* (Land-snail), *Bulimus, Pupa.*
Fam. *b.* Limacidæ.—*Limax* (Slug).
Fam. *c.* Limnæidæ.—*Limnæa, Planorbis.*
Fam. *d.* Auriculidæ.—*Auricula.*

ORDER II.—OPERCULATA.

Fam. *a.* Cyclostomidæ.—*Cyclostoma.*
Fam. *b.* Aciculidæ.—*Acicula.*
Fam. *c.* Helicinidæ.—*Helicina.*

(H. and A. Adams, *The Genera of Recent Mollusca*, London, 1858; Keferstein, *Malacozoa Cephalophora*, in Bronn's Klassen und Ordnungen des Thierreichs, 1862-66; S. P. Woodward, *Manual of the Mollusca*, 3d ed., 1875; Huxley, *On the Morphology of the Cephalous Mollusca*, Phil. Trans., 1853; Troschel, *Das Gebiss der Schnecken*, 1856; Stoliczka, *Cretaceous Gasteropoda of Southern India*, Palæontologia Indica, 1868.)

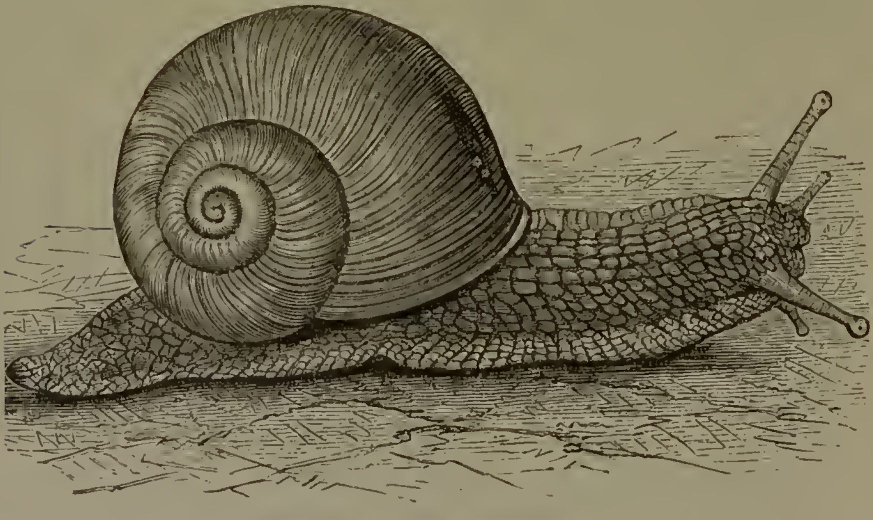

Fig. 74.—Gasteropoda. The Garden Snail (*Helix aspersa*).

CLASS III.—PTEROPODA.

ORDER I.—GYMNOSOMATA.

Fam. Cliidæ.—*Clio, Pneumodermon.*

ORDER II.—THECOSOMATA.

Fam. *a.* Hyaleidæ.—*Hyalea, Cleodora.*
Fam. *b.* *Hyolithidæ.—*Hyolithes* (*Theca*).
Fam. *c.* Cymbuliidæ.—*Cymbulia.*
Fam. *d.* Limacinidæ.—*Limacina, Spirialis.*

(Rang et Souleyet, *Histoire naturelle des Mollusques Ptéropodes*, Paris, 1852; Gegenbaur, *Untersuchungen über die Pteropoden und Heteropoden*, Leipzig, 1853; Krohn, *Beiträge zur Entwickelungsgeschichte der Pteropoden und Heteropoden*, Leipzig, 1860; Barrande, *Ptéropodes*, in the 'Système Silurien du Centre de la Bohême,' 1867.)

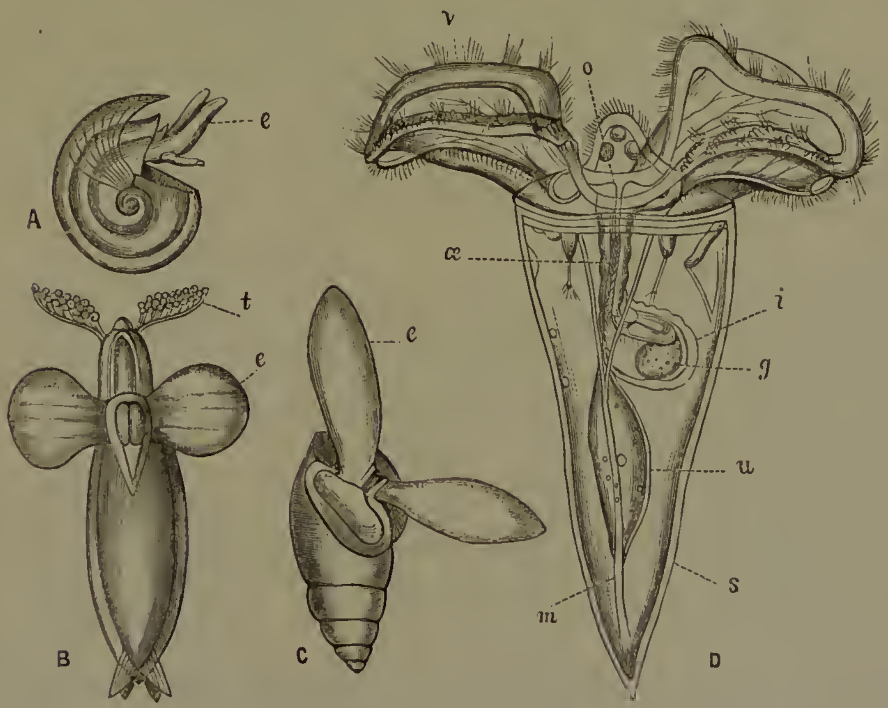

Fig. 75.—Pteropoda. A, *Spirialis rostralis* B, *Pneumodermon violaceum.* C, *Heterofusus buliminoides.* All enlarged. *e*, Epipodia or fins; *t*, Tentacles. D, Larva of *Cleodora lanceolata*, greatly enlarged (after Fol): *v*, Velum; *o*, Mouth; *æ*, Gullet; *g*, Stomach; *i*, Intestine; *m*, Columellar muscle; *s*, Shell; *u*, Yolk-sac.

CLASS IV.—CEPHALOPODA.

ORDER I.—DIBRANCHIATA (Cuttle-fishes).

Sub-ord. 1. Octopoda.

Fam. *a.* Octopodidæ.—*Octopus* (Poulpe), *Eledone.*
Fam. *b.* Argonautidæ.—*Argonauta* (Paper Nautilus).

Sub-ord. 2. Decapoda.

Fam. *a.* Spirulidæ.—*Spirula* (Post-horn).
Fam. *b.* *Belemnitidæ.—*Belemnites, Belemnitella.*
Fam. *c.* Sepiadæ.—*Sepia.*
Fam. *d.* Sepiolidæ.—*Sepiola, Rossia.*
Fam. *e.* Loliginidæ (Teuthidæ).—*Loligo* (Calamary).
Fam. *f.* Chiroteuthidæ.—*Chiroteuthis, Ommastrephes.*
Fam. *g.* Loligopsidæ.—*Loligopsis.*
Fam. *h.* Cranchiidæ.—*Cranchia.*

ORDER II.—TETRABRANCHIATA.

Sub-ord. 1. Nautiloidea.

Fam. *a.* Nautilidæ.—*Nautilus* (Pearly Nautilus), **Lituites.*
Fam. *b.* *Orthoceratidæ.—*Orthoceras, Cyrtoceras.*

Sub-ord. 2. *Ammonitoidea.

Fam. *a.* *Goniatitidæ.—*Goniatites, Bactrites.*
Fam. *b.* *Ceratitidæ.—*Ceratites.*
Fam. *c.* *Ammonitidæ.—*Ammonites, Baculites, Scaphites.*

(Ferussac and D'Orbigny, *Histoire naturelle des Céphalopodes acétabulifères vivants et fossiles*, Paris, 1835-48 ; Owen, Art. "*Cephalopoda*," in Todd's Cyclopædia of Anat. and Phys., 1836 ; Owen, *Memoir on the Pearly Nautilus*, 1832 ; Hyatt, *Embryology of the Tetrabranchiates*, Bull. Mus. Comp.

Zool., 1872; Quenstedt, *Die Cephalopoden*, 1846; Barrande, *Céphalopodes*, in 'Système Silurien du Centre de la Bohême,' 1872-77.)

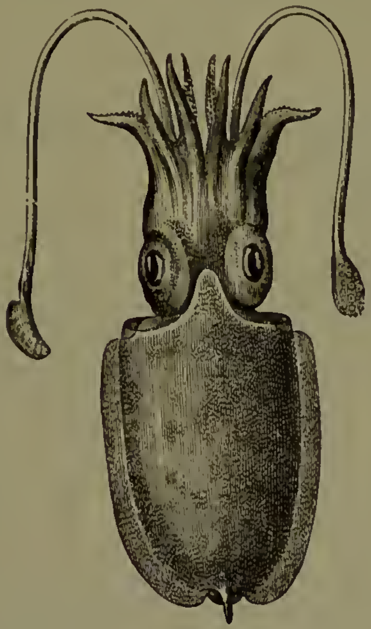

Fig. 76.—Cephalopoda. *Sepia elegans.*

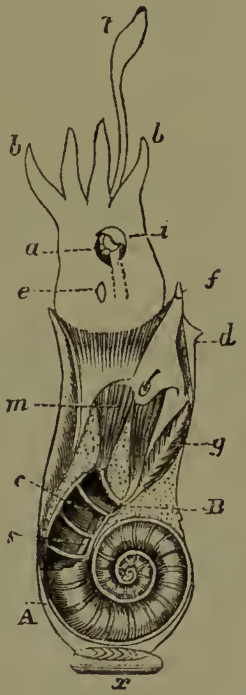

Fig. 77.—Anatomy of *Spirula australis* (after Owen), showing the position of the skeleton.

SUB-KINGDOM (TYPE) VI.—VERTEBRATA (CHORDATA).

The body in the Vertebrata is usually composed of a number of more or less definite segments (very obscure in the Cyclostomatous Fishes), which are arranged along a longitudinal axis. The nervous system is in its main masses dorsal, and the neural and hæmal regions of the body are always completely separated from one another. The cerebro-spinal nervous axis is underlaid by the structure known as the "notochord," which, in adult life, is usually more or less completely replaced by the bony axis known as the "spine" or "vertebral column." The limbs are sometimes absent; but, when present, they are never more than four in number, and are always turned away from the neural aspect of the body.

DIVISION A.—ICHTHYOPSIDA.

CLASS I.—PISCES (FISHES).

ORDER I.—PHARYNGOBRANCHII.

Fam. Cirrostomi.—Amphioxus (Lancelet, fig. 78).

(J. Müller, *Ueber den Bau und die Lebenserscheinungen der Branchiostoma lubricum*, Abhandl. der Berl. Akad., 1842; Kowalevsky, *Entwickelungsgeschichte von Amphioxus lanceolatus*, St Petersburg, 1867.)

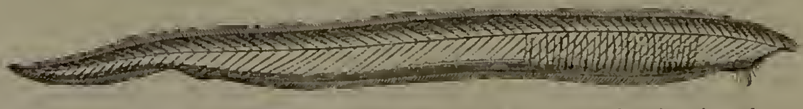

Fig. 78.—Pharyngobranchii. The Lancelet (*Amphioxus lanceolatus*), enlarged.

ORDER II.—MARSIPOBRANCHII (CYCLOSTOMATA).

Fam. *a.* Myxinidæ.—*Myxine* (Hag-fish).
Fam. *b.* Petromyzonidæ.—*Petromyzon* (Lamprey).

(J. Müller, *Vergleichende Anatomie der Myxinoiden*, Abhandl. der Berlin Akad., 1835-1845.)

ORDER III.—TELEOSTEI (Bony Fishes).

Sub-ord. 1. Malacopteri (Physostomi).

Section A. Apoda.

Families: Murænidæ, Symbranchidæ, Gymnotidæ. —*Muræna* (Eel), *Symbranchus*, *Gymnotus* (Electric-eel).

Section B. Abdominalia.

Families: Clupeidæ, Esocidæ, Cyprinidæ, Salmonidæ, Siluridæ.—*Clupea* (Herring), *Esox* (Pike), *Cyprinus* (Carp), *Salmo* (Salmon), *Silurus* (Sheat-fish).

Sub-ord. 2. Anacanthini.

Section A. Gadoidei.

Families: Gadidæ, Ophidiidæ, Macruridæ.—*Gadus* (Cod), *Ammodytes* (Sand-eel), *Bathygadus*.

Section B. Pleuronectoidea.

Fam. Pleuronectidæ (Flat-fishes). — *Pleuronectes* (Plaice), *Rhombus* (Turbot), *Solea* (Sole).

Sub-ord. 3. Acanthopteri.

Section A. Pharyngognathi.

Families: Pomacentridæ, Labridæ, Chromidæ.—*Pomacentrus*, *Labrus* (Wrasse), *Chromis*.

Section B. Acanthopteri veri.

Families: Percidæ, Mugilidæ, Scomberidæ, Sclerogenidæ, Gobiidæ, Blenniidæ, Lophiidæ. — *Perca* (Perch), *Mugil* (Mullet), *Scomber* (Mackerel), *Cottus* (Bull-head), *Gobius* (Goby), *Anarrhicas* (Wolf-fish), *Lophius* (Angler).

Sub-ord. 4. Plectognathi.

Section A. Sclerodermi.

Families: Balistidæ, Ostraciontidæ.—*Balistes* (File-fish), *Ostracion* (Trunk-fish).

Section B. Gymnodontes.

Families: Tetrodontidæ, Molidæ.—*Diodon* (Globe-fish), *Orthagoriscus* (Sun-fish).

Sub-ord. 5. Lophobranchii.

Families: Solenostomidæ, Syngnathidæ, Hippocampidæ.—*Solenostoma*, *Syngnathus* (Pipe-fish), *Hippocampus* (Sea-horse).

(Günther, *An Introduction to the Study of Fishes*, 1880; Günther, *Catalogue of the Fishes in the Collection of the British Museum*, 1859-70; Cuvier et Valenciennes, *Histoire naturelle des Poissons*, Paris, 1828.)

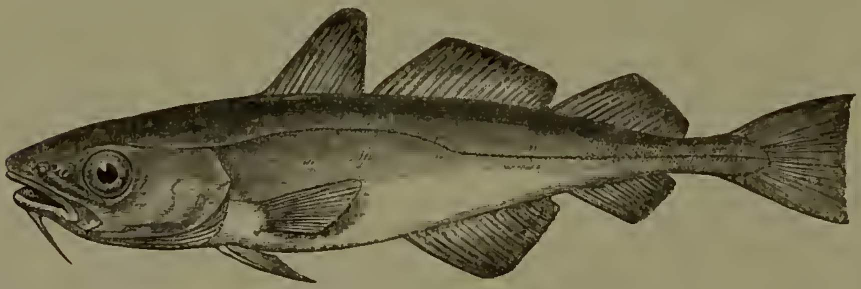

Fig. 79.—Teleostei. The Cod (*Gadus morrhua*).

ORDER IV.—GANOIDEI.

Sub-ord. 1. Amioidea.

Fam. Amiadæ.—*Amia.*

Sub-ord. 2. Lepidosteoidea.

Fam. *a.* Lepidosteidæ.—*Lepidosteus* (Bony-pike).
Fam. *b.* *Palæoniscidæ.—*Palæoniscus.*
Fam. *c.* *Platysomidæ.—*Platysomus.*
Fam. *d.* *Dapediidæ.—*Dapedius.*
Fam. *e.* *Lepidotidæ.—*Lepidotus.*
Fam. *f.* *Leptolepidæ.—*Leptolepis.*
Fam. *g.* *Pycnodontidæ.—*Pycnodus.*

Sub-ord. 3. Crossopterygidæ.
  Fam. *a.* Polypteridæ.—*Polypterus, Calamoichthys.*
  Fam. *b.* *Cœlacanthidæ.—*Cœlacanthus.*
  Fam. *c.* *Rhombodipteridæ.—*Glyptolæmus, Osteolepis.*
  Fam. *d.* *Cyclodipteridæ.—*Tristichopterus.*
  Fam. *c.* *Holoptychiidæ.—*Holoptychius.*
  Fam. *f.* *Phaneropleuridæ.—*Phaneropleuron.*

Sub-ord. 4. *Acanthophori.
  Fam. Acanthodidæ.—*Acanthodes.*

Sub-ord. 5. *Ostracostei.
  Fam. *a.* Cephalaspidæ.—*Cephalaspis.*
  Fam. *b.* Pterichthyidæ.—*Pterichthys.*

Sub-ord. 5. Chondrosteidæ.
  Fam. *a.* Acipenseridæ. — *Acipenser* (Sturgeon), *Scaphirhynchus.*
  Fam. *b.* Polyodontidæ.—*Polyodon* (= *Spatularia,* Paddle-fish).

(Joh. Müller, *Ueber Ganoiden und das natürliche System der Fische*, Abhandl. der Berl. Akad., 1848 ; Agassiz, *Recherches sur les Poissons fossiles*, 1833-43 ; Huxley, *Essay upon the Systematic Arrangement of the Fishes of the Devonian Epoch*, Mem. Geol. Survey, 1861 ; and *Illustrations of the Structure of the Crossopterygian Ganoids*, ibid., 1866 ; Traquair, *The Ganoids of the British Carboniferous Formation*, Palæontograph. Soc., 1877.)

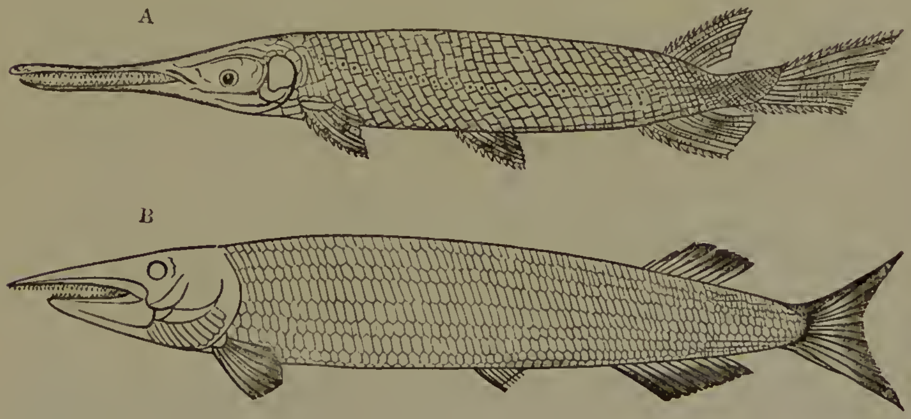

Fig. 80.—A, *Lepidosteus osseus*, the "Gar-Pike" of the American Lakes ; B, *Aspidorhynchus*, restored (after Agassiz), a Jurassic Ganoid allied to *Lepidosteus*, but having a homocercal tail.

ORDER V.—ELASMOBRANCHII (CHONDROPTERYGII).

Sub-ord. 1. Holocephali.

Fam. Chimæridæ.—*Chimæra, Callorhynchus.*

Sub-ord. 2. Plagiostomi.

Section A. Selachoidei.

Fam. *a.* Carchariidæ.—*Carcharias* (Shark), *Galeus* (Tope).
Fam. *b.* Lamnidæ.—*Lamna* (Porbeagle), *Carcharodon, Selache* (Basking Shark).
Fam. *c.* Rhinodontidæ.—*Rhinodon.*
Fam. *d.* Notidanidæ.—*Notidanus.*
Fam. *e.* Scylliidæ.—*Scyllium* (Dog-fish).
Fam. *f.* Spinacidæ.—*Spinax, Acanthias* (Piked Dog-fish).
Fam. *g.* Rhinidæ.—*Rhina* (Monk-fish).
Fam. *h.* Pristiophoridæ.—*Pristiophorus.*

Section B. Cestraphori.

Fam. *a.* Cestraciontidæ.—*Cestracion* (Port-Jackson Shark), **Acrodus.*
Fam. *b.* *Hybodontidæ.—*Hybodus.*

Section C. Batoidei.

Fam. *a.* Pristidæ.—*Pristis* (Saw-fish).
Fam. *b.* Rhinobatidæ.—*Rhinobatis.*
Fam. *c.* Torpedinidæ.—*Torpedo* (Electric Ray).
Fam. *d.* Raiidæ.—*Raia* (Skate).
Fam. *e.* Trygonidæ.—*Trygon* (Sting-Ray).
Fam. *f.* Myliobatidæ.—*Myliobatis* (Eagle-Ray).

(J. Müller and Henle, *Systematische Beschreibung der Plagiostomen*, Berlin, 1841; F. M. Balfour, *Monograph on the Development of the Elasmobranch Fishes*, 1878; Günther, *An Introduction to the Study of Fishes*, 1880.)

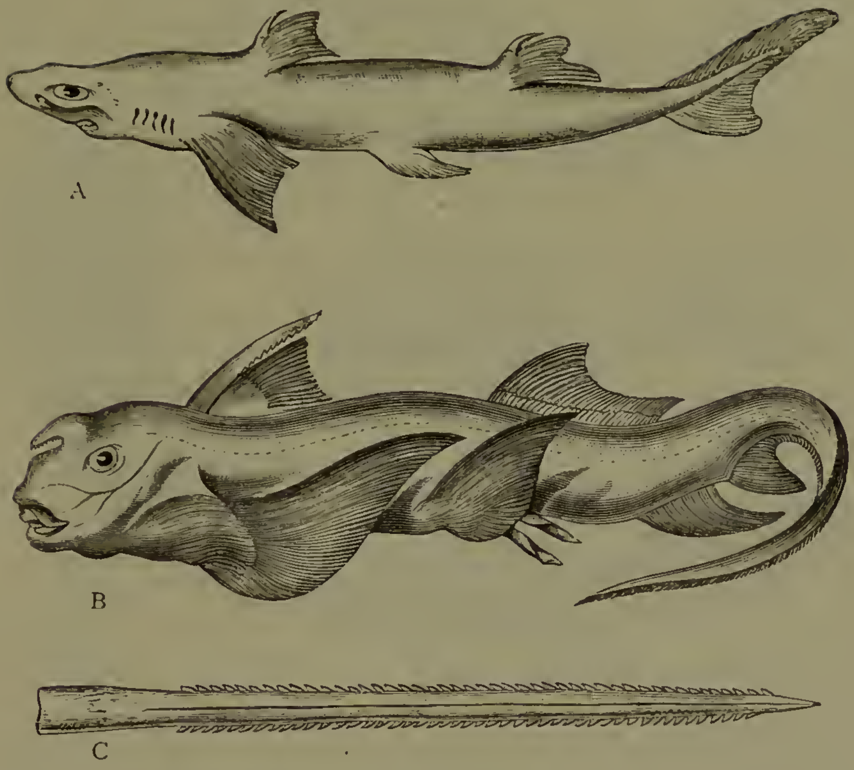

Fig. 81.—A, *Spinax acanthias*, one of the Dog-fishes ; B, *Chimæra monstrosa* ; C, Tail-spine of an Eagle-Ray (*Myliobatis*).

ORDER VI.—DIPNOI.

Sub-ord. 1. Sirenoidei.

Fam. *a.* Lepidosirenidæ.—*Lepidosiren, Protopterus.*
Fam. *b.* Ceratodidæ.—*Ceratodus* (" Jeevine ").

Sub-ord. 2. *Ctenodipterini.—*Dipterus, Ctenodus.*

(Hyrtl, *Lepidosiren paradoxa, Monographie*, Prag, 1845 ; Owen, *Description of the Lepidosiren annectens*, Trans. Linn. Soc., 1840 ; Günther, *Description of Ceratodus*, Phil. Trans., 1872 ; Huxley, *Structure of Ceratodus*, Proc. Zool. Soc., 1876 ; Pander, *Die Ctenodipterinen des Devonischen Systems*, 1858 ; Traquair, *On the Genus Dipterus*, &c., Ann. and Mag. Nat. Hist., 1878.)

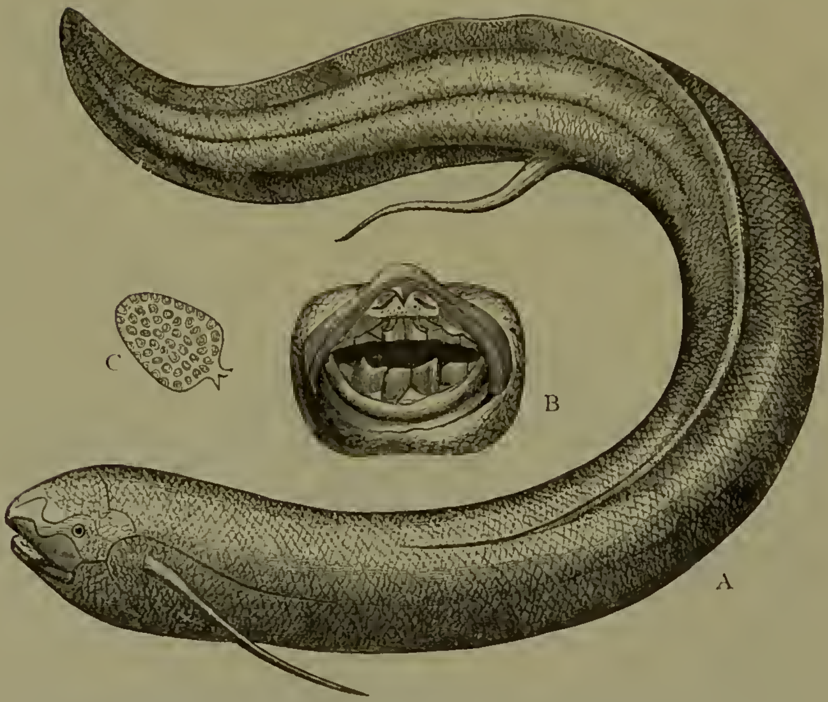

Fig. 82.—A, *Lepidosiren paradoxa*, one of the Mud-fishes ; B, Front of the mouth of the same, showing the teeth ; C, One of the overlapping scales, enlarged.

CLASS II.—AMPHIBIA (AMPHIBIANS).

Order I.—Ophiomorpha (Peromela).

Fam. Cæciliidæ.—*Cæcilia, Siphonops, Epicrium.*

Order II.—Urodela.

Sub-ord. 1. Ichthyodea.

Fam. *a.* Perennibranchiata or Phanerobranchia.—*Siren, Proteus, Menobranchus, Siredon.*

Fam. *b.* Cryptobranchia.—*Amphiuma, Menopoma, Cryptobranchus.*

Sub-ord. 2. Salamandrina.

Fam. *a.* Amblystomidæ.—*Amblystoma, Plethodon.*

Fam. *b.* Salamandriidæ.—*Triton* (Newt), *Salamandra* (Land-Salamander).

The genus *Siredon* (Axolotl), if regarded as a permanent type, must be placed, as above, among the Perennibranchiate Urodela. It has been shown, however, by Dumeril, Marsh, and others, that under certain circumstances the Axolotl may lose its gills, and may undergo other changes, by which it becomes an *Amblystoma*. There would, therefore, be no impropriety in regarding the ordinary Axolotls as persistent larvæ, and in placing the genus *Siredon* among the *Amblystomidæ*.

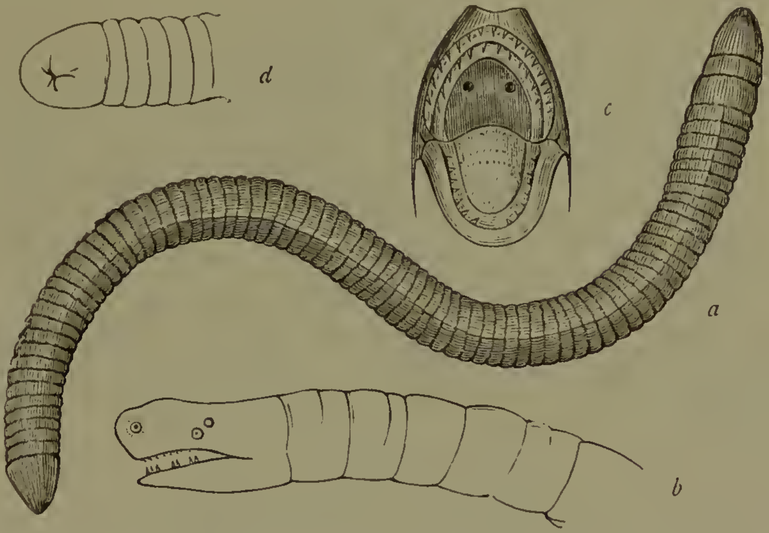

Fig. 83.—Ophiomorpha. *a*, *Siphonops annulatus*, one of the Cæcilians, much reduced; *b*, Head; *c*, Mouth, showing the tongue, teeth, and internal openings of the nostrils; *d*, Tail and cloacal aperture. (After Dumeril and Bibron.)

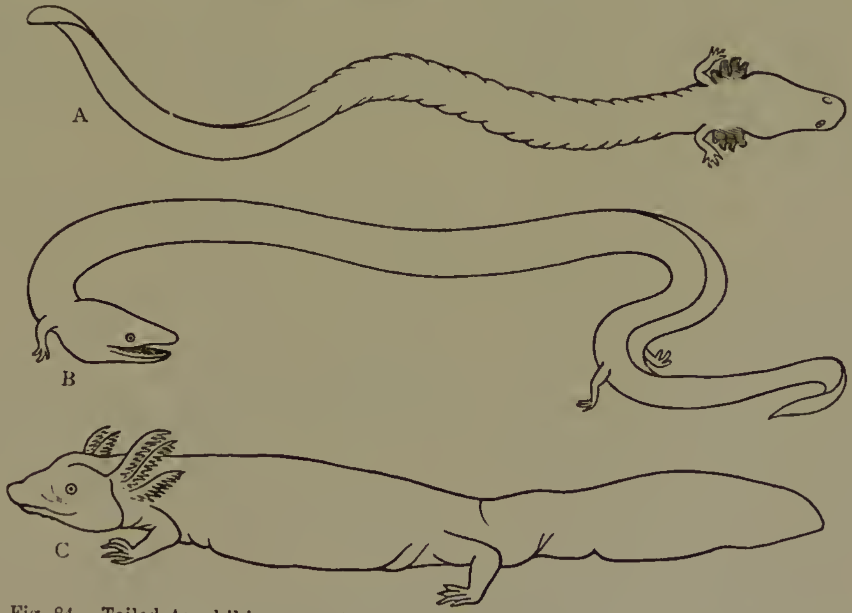

Fig. 84.—Tailed Amphibians. A, *Siren lacertina;* B, *Amphiuma*, showing the four minute limbs; C, *Menobranchus maculatus*. (After Mivart.)

Order III.—Anoura.

Sub-ord. 1. Aglossa.

Fam. *a.* Pipidæ.—*Pipa* (Surinam Toad).
Fam. *b.* Dactylethridæ.—*Dactylethra.*

Sub-ord. 2. Phaneroglossa.

Fam. *a.* Ranidæ (Frogs).—*Rana, Pseudis, Discoglossus, Ceratophrys.*
Fam. *b.* Pelobatidæ.—*Alytes* (Obstetric Toad), *Pelobates, Bombinator.*
Fam. *c.* Bufonidæ (Toads).—*Bufo, Rhinophrynus.*
Fam. *d.* Hylidæ (Tree-frogs).—*Hyla, Notodelphys.*
Fam. *e.* Phyllomedusidæ.—*Phyllomedusa.*
Fam. *f.* Dendrobatidæ.—*Dendrobates.*

The families *Ranidæ*, *Pelobatidæ*, and *Bufonidæ* are often grouped together as a section of the *Phaneroglossa* under the name of *Oxydactyla;* while the last three families form a section to which the name of *Discodactyla* is given on account of the fact that the toes end in suctorial discs.

Order IV.—*Labyrinthodontia.—*Labyrinthodon, Mastodonsaurus, Anthracosaurus, Loxomma, Archegosaurus.*

(Huxley, *Article* "*Amphibia*," Encyclopædia Britann., 1875; Günther, *Catalogue of the Batrachia salientia in the Collections of the British Museum*, 1858; Mivart, *The Common Frog*, 1874; Dumeril et Bibron, *Erpétologie générale*, 1834-54; Leydig, *Ueber die Schleichenlurche* (*Cæciliæ*), Zeitschr. für Wiss. Zool., 1867.)

CLASS III.—REPTILIA (REPTILES).

Order I.—Chelonia.

Fam. *a.* Cheloniidæ (Sea-Turtles).—*Chelone, Sphargis.*
Fam. *b.* Trionycidæ (Soft Tortoises).—*Trionyx.*
Fam. *c.* Chelydidæ.—*Chelys.*
Fam. *d.* Emydidæ. — *Emys* (Terrapin), *Cistudo* (Box-Tortoise).
Fam. *e.* Testudinidæ (Land-Tortoises).—*Testudo, Pyxis.*

(Gray, *Catalogue of the Shield Reptiles in the Collections of the British*

Museum, 1855; Bojanus, *Anatomia testudinis europææ*, 1819-21; Bell, *Monograph of the Testudinata*, Ray Soc., 1836.)

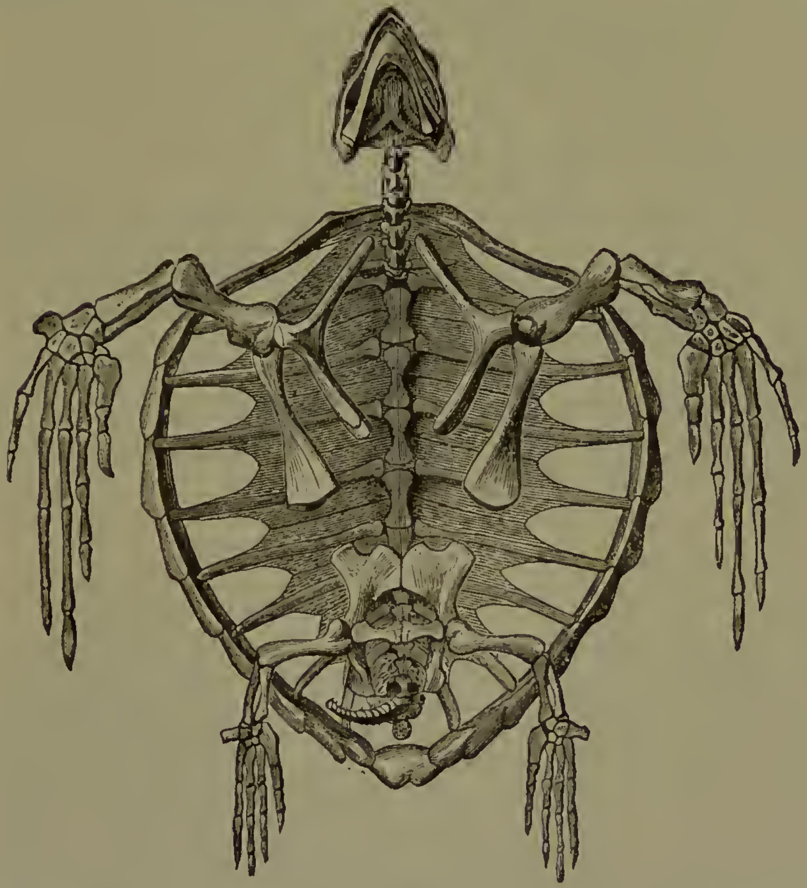

Fig 85. –Skeleton and carapace of the Logger-headed Turtle (*Chelone caouanna*), viewed from below, the plastron being removed.

ORDER II.—OPHIDIA (SERPENTS).

Section A. Stenostomata.

Fam. *a.* Typhlopidæ.—*Typhlops.*
Fam. *b.* Tortricidæ.—*Tortrix.*
Fam. *c.* Uropeltidæ.—*Uropeltis.*

Section B. Eurystomata.

Sub-ord. 1. Aglyphodontia.

Families: Colubridæ.—*Coluber, Tropidonotus.* Dendrophidæ. — *Dendrophis.* Dipsadidæ. — *Dipsas.* Boidæ.—*Boa, Python, Eunectes.*

Sub-ord. 2. Proteroglypha.

Fam. *a.* Elapidæ.—*Elaps, Bungarus, Naja* (Cobra), *Ophiophagus* (Hamadryad).

Fam. *b.* Hydrophidæ (Sea-snakes).—*Hydrophis, Platurus.*

Sub-ord. 3. Solenoglypha.

Fam. *a.* Viperidæ.—*Vipera, Pelias, Cerastes, Clotho.*

Fam. *b.* Crotalidæ.—*Crotalus* (Rattle-snake), *Ancistrodon* (Copperhead), *Bothrops* (Fer-de-lance), *Halys, Trimeresurus.*

(Dumeril et Bibron, *Erpétologie générale*, Paris, 1834-45; Günther, *Catalogue of Colubrine Snakes in the Collection of the British Museum*, 1858; Fayrer, *Thanatophidia of India*, 1873.)

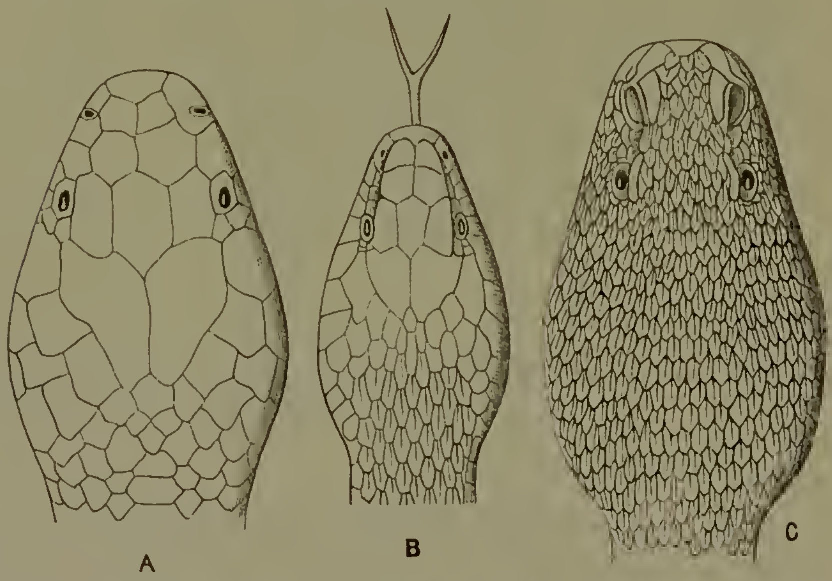

Fig. 86.—Ophidia. A, Head of an Elapine Snake (*Bungarus fasciatus*), viewed from above; B, Head of a Colubrine Snake (*Tropidonotus natrix*); C, Head of a Viperine Snake (*Daboia Russellii*). (A and C are after Sir Joseph Fayrer; B is after Bell.)

ORDER III.—LACERTILIA (LIZARDS).

Sub-ord. 1. Amphisbænoidea (Annulata).

Fam. *a.* Amphisbænidæ.—*Amphisbæna.*

Fam. *b.* Chirotidæ.—*Chirotes.*

Sub-ord. 2. Fissilinguia.

Fam. *a.* Lacertidæ.—*Lacerta, Zootoca.*
Fam. *b.* Ameividæ.—*Ameiva, Tejus.*
Fam. *c.* Varanidæ.—*Varanus* (Monitor).

Sub-ord. 3. Brevilinguia.

Fam. *a.* Scincoideæ.—*Scincus* (Skink), *Anguis* (Blindworm), *Cyclodus, Seps.*
Fam. *b.* Chalcididæ.—*Chalcides.*
Fam. *c.* Zonuridæ.—*Zonurus, Pseudopus* (Sheltopusik).
Fam. *d.* Geckotidæ (Ascalabotæ).—*Gecko.*
Fam. *e.* Iguanidæ.—*Iguana, Basiliscus, Draco* (fig. 87).
Fam. *f.* Agamidæ.—*Agama, Stellio.*

Sub-ord. 4. Vermilinguia.

Fam. Chamæleontidæ.—*Chamæleo.*

Sub-ord. 5. Rhynchocephalia.

Fam. Hatteriidæ.—*Hatteria* (" Tuatara ").

Sub-ord. 6. *Mosasauria.—*Mosasaurus, Leiodon.*

Sub-ord. 7. *Protorosauria.—*Protorosaurus.*

(Dumeril et Bibron, *Erpétologie générale*, 1834-45 ; Günther, *Anatomy of Hatteria*, Phil. Trans., 1867.)

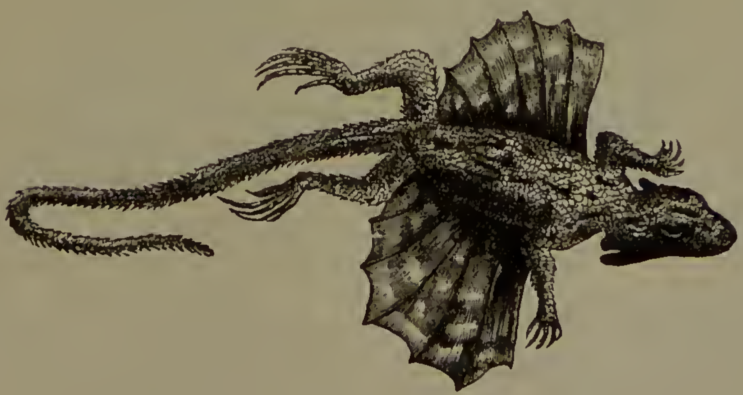

Fig. 87.—Lacertilia. The " Flying Dragon " (*Draco volans*), viewed from above, of the natural size.

ORDER IV.—CROCODILIA.

Sub-ord. 1. Procœlia.

Fam. *a.* Crocodilidæ.—*Crocodilus* (Crocodile).
Fam. *b.* Gavialidæ.—*Gavialis* (Gavial).
Fam. *c.* Alligatoridæ.—*Alligator.*

Sub-ord. 2. *Amphicœlia. — *Belodon*, *Stagonolepis*, *Teleosaurus.*

Sub-ord. 3. *Opisthocœlia.—*Streptospondylus.*

(Rathke, *Untersuchungen über die Entwickelung und den Körperbau der Krokodile*, Braunschweig, 1866 ; Strauch, *Synopsis der gegenwärtig lebenden Crocodile*, Mém. de l'Acad. de St Petersbourg, 1866 ; Miall, *The Skull of the Crocodile*, 1878 ; Günther, *The Reptiles of British India*, 1864.)

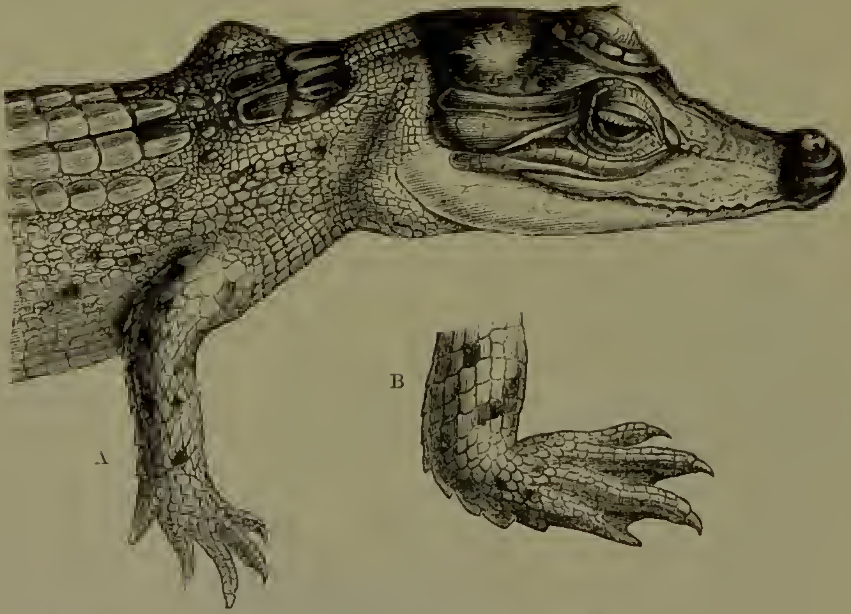

Fig. 88.—A, Head and anterior portion of the body of *Crocodilus pondicerianus*; B, Hind-foot of the same. (After Günther.)

ORDER V.—*ICHTHYOPTERYGIA.—*Ichthyosaurus.*
ORDER VI.—*SAUROPTERYGIA.—*Plesiosaurus, Pliosaurus.*
ORDER VII.—*ANOMODONTIA.—*Dicynodon, Oudenodon.*
ORDER VIII.—*PTEROSAURIA.—*Pterodactylus, Rhamphorhynchus, Pteranodon.*
ORDER IX.—*DEINOSAURIA.—*Iguanodon, Megalosaurus.*
ORDER X.—*THERIODONTIA.—*Cynodraco.*

CLASS IV. — AVES (BIRDS).

SUB-CLASS I.—RATITÆ.

ORDER.—CURSORES.

Fam. *a.* Struthionidæ.—*Struthio* (Ostrich).
Fam. *b.* Rheidæ.—*Rhea* (American Ostrich).
Fam. *c.* Dromæidæ.—*Dromaius* (Emeu).
Fam. *d.* Casuariidæ.—*Casuarius* (Cassowary).
Fam. *e.* *Dinornithidæ.—*Dinornis.*
Fam. *f.* *Æpyornithidæ.—*Æpyornis.*
Fam. *g.* Apterygidæ.—*Apteryx* (fig. 89).

(Owen, *Memoir on Dinornis*, Lond., 1866-73; Owen, *Anatomy of the Southern Apteryx*, Trans. Zool. Soc., 1838 and 1842; Owen, *On Dinornis*, Trans. Zool. Soc., 1839-64; Parker, *On the Skull of the Ostrich*, Phil. Trans., 1866.)

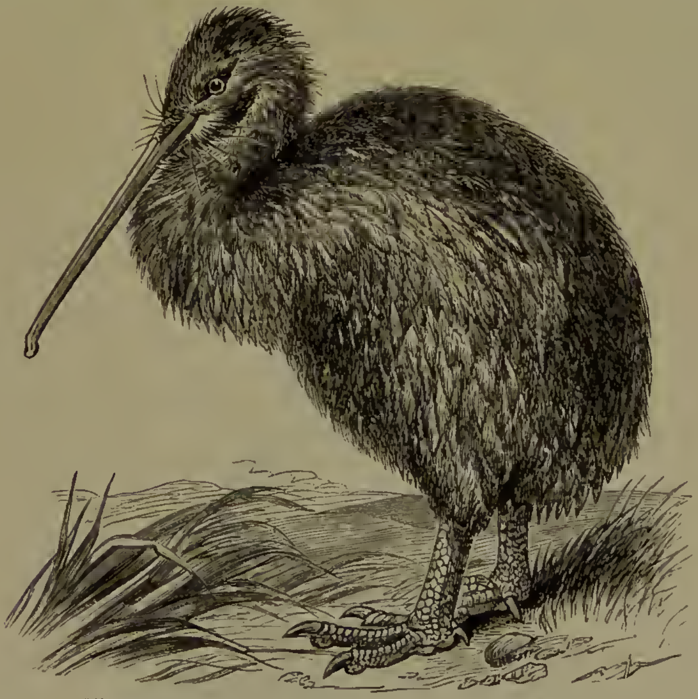

Fig. 89.—Cursores. *Apteryx australis*, New Zealand.

SUB-CLASS II.—CARINATÆ.

ORDER I.—NATATORES.

Sub-ord. 1. Brevipennatæ.
Fam. *a.* Spheniscidæ (Penguins).—*Spheniscus, Aptenodytes.*

Fam. *b.* Alcidæ.—*Alca* (Auk and Razorbill), *Uria* (Guillemot), *Fratercula* (Puffin).

Fam. *c.* Colymbidæ.—*Colymbus* (Diver), *Podiceps* (Grebe).

Sub-ord. 2. Longipennatæ.

Fam. *a.* Laridæ.—*Larus* (Gull).

Fam. *b.* Sternidæ.—*Sterna* (Tern).

Fam. *c.* Procellaridæ.—*Procellaria* (Fulmar), *Thalassidroma* (Petrel), *Diomedea* (Albatross).

Sub-ord. 3. Totipalmatæ.

Fam. *a.* Pelecanidæ.—*Sula* (Gannet), *Phalacrocorax* (Cormorant), *Pelecanus* (Pelican), *Plotus* (Darter).

Fam. *b.* Tachypetidæ.—*Tachypetes* (Frigate-bird).

Fam. *c.* Phaëtontidæ.—*Phaëton* (Tropic-bird).

Sub-ord 4. Lamellirostres.

Fam. *a.* Anatidæ (Ducks).—*Anas, Fuligula.*

Fam. *b.* Anseridæ (Geese).—*Anser, Cercopsis.*

Fam. *c.* Cygnidæ (Swans).—*Cygnus.*

Fam. *d.* Phœnicopteridæ.—*Phœnicopterus* (Flamingo).

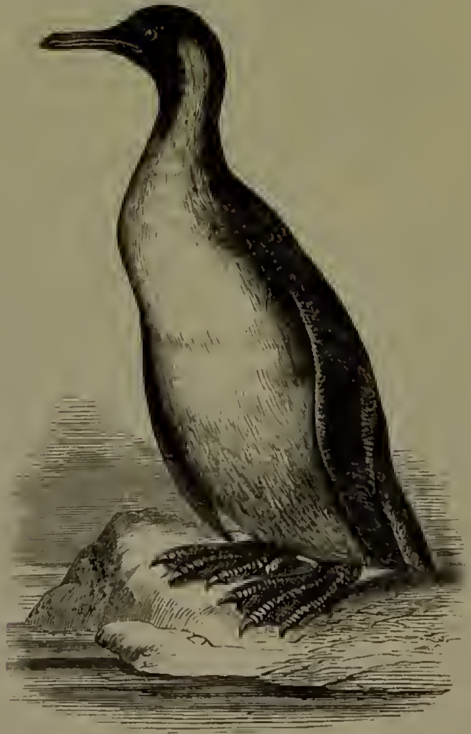

Fig. 90.—Natatores. Penguin (*Aptenodytes patagonica*).

ORDER II.—GRALLATORES.

Sub-ord. 1. Macrodactyli.

Fam. *a.* Rallidæ.—*Rallus* (Rail), *Gallinula* (Waterhen).
Fam. *b.* Parridæ.—*Parra* (Jacana).
Fam. *c.* Palamedeidæ.—*Palamedea* (Screamer).

Sub-ord. 2. Cultirostres.

Fam. *a.* Gruidæ.—*Grus* (Crane).
Fam. *b.* Ardeidæ.—*Ardea* (Heron), *Botaurus* (Bittern).
Fam. *c.* Tantalidæ.—*Tantalus, Ibis.*
Fam. *d.* Ciconiidæ.—*Ciconia* (Stork).
Fam. *e.* Plataleadæ.—*Platalea* (Spoonbill).

Sub-ord. 3. Longirostres.

Fam. Scolopacidæ.—*Scolopax* (Snipe), *Numenius* (Curlew).

Sub-ord. 4. Pressirostres.

Fam. *a.* Charadriidæ.—*Charadrius* (Plover), *Vanellus* (Lapwing).
Fam. *b.* Otidæ.—*Otis* (Bustard).

ORDER III.—RASORES.

Sub-ord. 1. Gallinacei (Clamatores).

Fam. *a.* Tetraonidæ.—*Tetrao* (Grouse), *Lagopus* (Ptarmigan).
Fam. *b.* Perdicidæ.—*Perdix* (Partridge), *Coturnix* (Quail).
Fam. *c.* Phasianidæ.—*Phasianus* (Pheasant), *Pavo* (Peafowl), *Meleagris* (Turkey), *Gallus* (Fowl).
Fam. *d.* Pteroclidæ.—*Pterocles* (Sand-grouse).
Fam. *e.* Turnicidæ.—*Turnix* (Bush-Quail).
Fam. *f.* Megapodidæ.—*Megapodius* (Mound-bird).
Fam. *g.* Cracidæ.—*Crax* (Curassow).
Fam. *h.* Tinamidæ.—*Tinamus* (Tinamou).
Fam. *i.* Opisthocomidæ.—*Opisthocomus* (Hoazin).

Sub-ord. 2. Columbacei (Gemitores).

Fam. *a.* Columbidæ (Pigeons).—*Columba, Turtur.*
Fam. *b.* Gouridæ (Ground-pigeons).—*Goura.*
Fam. *c.* Treronidæ (Tree-pigeons).—*Treron.*
Fam. *d.* Didunculidæ.—*Didunculus.*
Fam. *e.* *Dididæ.—*Didus* (Dodo).

ORDER IV.—SCANSORES.

Sub-ord. 1. Cuculiformes.

Fam. *a.* Cuculidæ.—*Cuculus* (Cuckoo), *Coccygus.*
Fam. *b.* Rhamphastidæ.—*Rhamphastos* (Toucan).
Fam. *c.* Musophagidæ.—*Musophaga* (Plantain-eater).
Fam. *d.* Bucconidæ.—*Bucco* (Barbet).
Fam. *e.* Coliidæ.—*Colius.*
Fam. *f.* Trogonidæ.—*Trogon.*

Sub-ord. 2. Piciformes.

Fam. *a.* Picidæ (Woodpeckers).—*Picus, Colaptes.*
Fam. *b.* Yungidæ.—*Yunx* (Wryneck).

Sub-ord. 3. Psittaciformes.

Fam. *a.* Psittacidæ (Parrots).—*Psittacus, Agapornis.*
Fam. *b.* Plyctolophidæ (Cockatoos).—*Plyctolophus.*
Fam. *c.* Macrocercidæ (Macaws).—*Macrocercus* (*Ara*), *Pezoporus.*
Fam. *d.* Trichoglossidæ.—*Trichoglossus* (Parrakeet), *Lorius* (Lory), *Nestor.*
Fam. *e.* Strigopidæ.—*Strigops* (Kakapo).

ORDER V.—INSESSORES (PASSERES).

Sub-ord. 1. Conirostres.

Families: Corvidæ.—*Corvus* (Crow), *Pica* (Magpie), *Garrulus* (Jay). Sturnidæ.—*Sturnus* (Starling), *Gracula.* Paradiseidæ (Birds of Paradise).—*Paradisea.* Oriolidæ.—*Oriolus.* Ampelidæ (Chatterers).—*Ampelis.* Fringillidæ (Finches).—*Passer* (Sparrow), *Emberiza* (Bunting). Tanagridæ.—*Tanagra.*

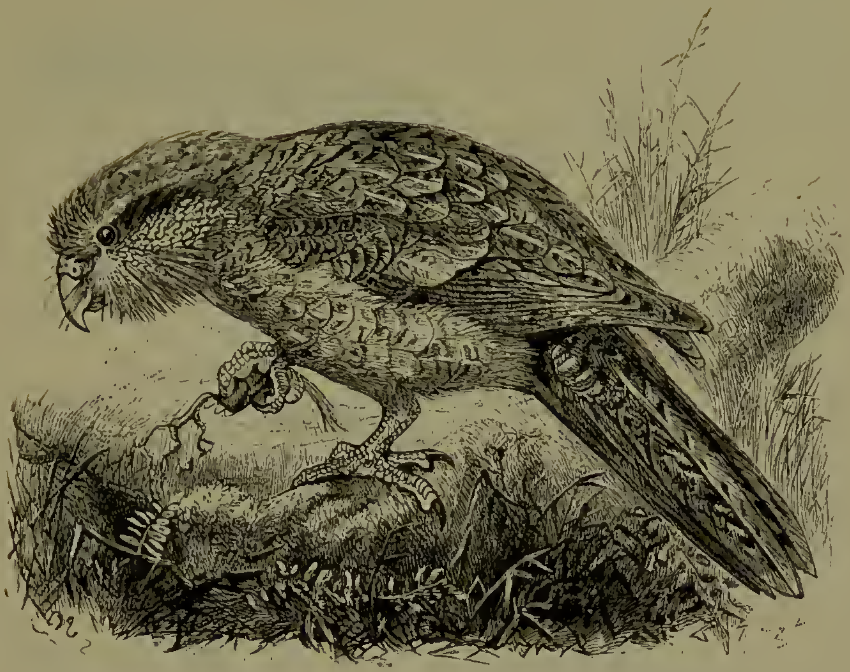

Fig. 91.—Scansores. The Owl-Parrot (*Strigops habroptilus*), New Zealand.

Sub-ord. 2. Dentirostres.

Families: Muscicapidæ. — *Muscicapa* (Fly-catcher). Laniidæ. — *Lanius* (Shrike). Sylviadæ. — *Sylvia* (Warbler), *Saxicola* (Stone-chat). Turdidæ.—*Turdus* (Thrush). Motacillidæ.—*Motacilla* (Wagtail), *Anthus* (Titlark). Troglodytidæ.—*Troglodytes* (Wren). Paridæ.—*Parus* (Titmouse). Tyrannidæ.—*Tyrannus*.

Sub-ord. 3.—Tenuirostres.

Families: Promeropidæ.—*Promerops*, *Nectarinia* (Sunbird). Meliphagidæ. — *Meliphaga* (Honey-eater). Certhiidæ. — *Certhia* (Creeper). Sittidæ. — *Sitta* (Nuthatch). Upupidæ.—*Upupa* (Hoopoe). Trochilidæ (Humming-birds).—*Trochilus*.

Sub-ord. 4. Fissirostres.

Families: Hirundinidæ (Swallows).—*Hirundo*. Cypselidæ (Swifts). — *Cypselus*, *Collocalia*. Caprimulgidæ (Goat-suckers).—*Caprimulgus*, *Steatornis*. Meropidæ (Bee-eaters).—*Merops*. Alcedinidæ (Kingfishers).—*Alcedo*, *Dacelo*.

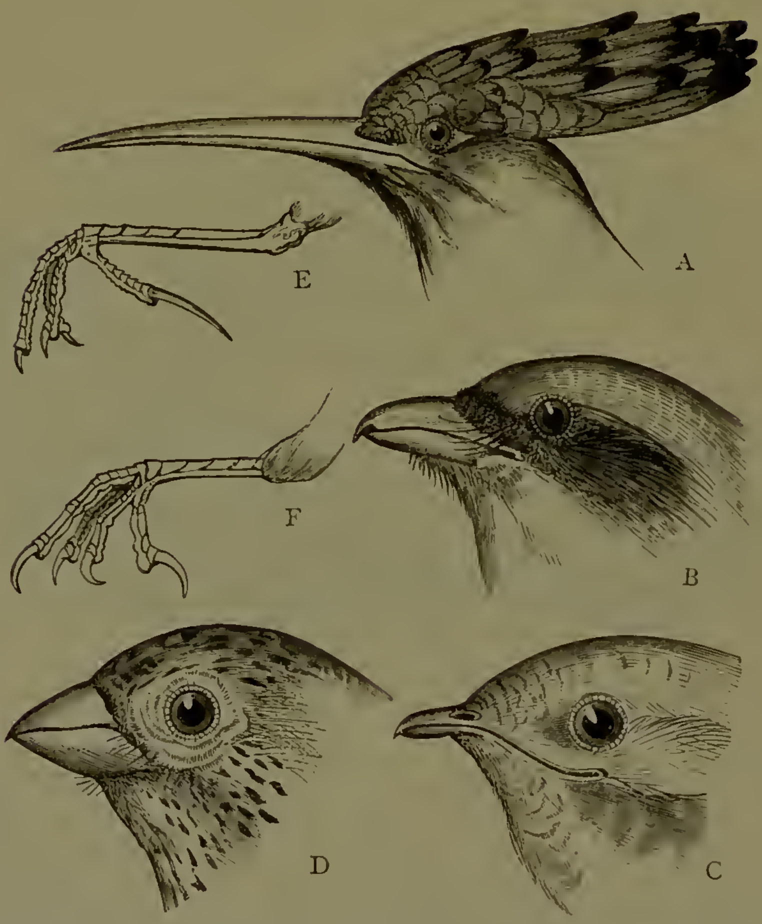

Fig. 92.—Insessores. A, Head of Hoopoe (*Upupa epops*), showing the Tenuirostral type of beak; B, Head of Red-backed Shrike (*Lanius collurio*), showing the Dentirostral type of beak; C, Head of White-bellied Swift (*Cypselus melba*), showing the Fissirostral type of beak; D, Head of Corn-Bunting (*Emberiza miliaria*), showing the Conirostral type of beak; E, Foot of the Yellow Wagtail (*Motacilla sulphurea*); F, Foot of a Finch (*Fringilla*).

ORDER VI.—RAPTORES (BIRDS OF PREY).

Fam. *a.* Strigidæ (Owls).—*Strix, Scops, Bubo, Athene.*

Fam. *b.* Falconidæ.—*Aquila* (Eagle), *Falco* (Falcon), *Buteo* (Buzzard), *Milvus* (Kite).

Fam. *c.* Vulturidæ (Vultures).—*Neophron, Gypaëtus.*

Fam. *d.* Cathartidæ (American Vultures).—*Cathartes* (Californian Vulture), *Sarcorhamphus* (Condor).

Fam. *e.* Gypogeranidæ.—*Gypogeranus* (Secretary Vulture).

(Gray, *Genera of Birds*, London, 1849; Newton, Article "*Birds*," Encyclopædia Brit., 9th ed., 1875; Owen, Article "*Aves*," Todd's Cyclopædia Anat. and Phys., 1836; Selenka, *Aves*, Bronn's Klassen und Ordnungen des Thierreichs, 1869-82; Huxley, *On the Classification of Birds*, Proc. Zool. Soc., 1867; Tiedemann, *Anatomie und Naturgeschichte der Vögel*, Heidelberg, 1848; Eyton, *Osteologia Avium*, London, 1858-60; Macgillivray, *History of British Birds*, 1839-41.)

SUB-CLASS III.—*SAURORNITHES.

ORDER.—SAURURÆ.—*Archæopteryx.*

SUB-CLASS IV.—*ODONTORNITHES.

ORDER I.—ODONTOLCÆ.—*Hesperornis.*
ORDER II.—ODONTOTORMÆ.—*Ichthyornis, Apatornis.*

(Owen, *Archæopteryx macrura*, Phil. Trans., 1863; Carl Vogt, *Archæopteryx*, Revue Scientifique, 1879; Marsh, *Jurassic Birds and their Allies*, Rep. Brit. Ass., 1881; Marsh, *Odontornithes, a Monograph of the Extinct Toothed Birds of North America*, New Haven, 1880.)

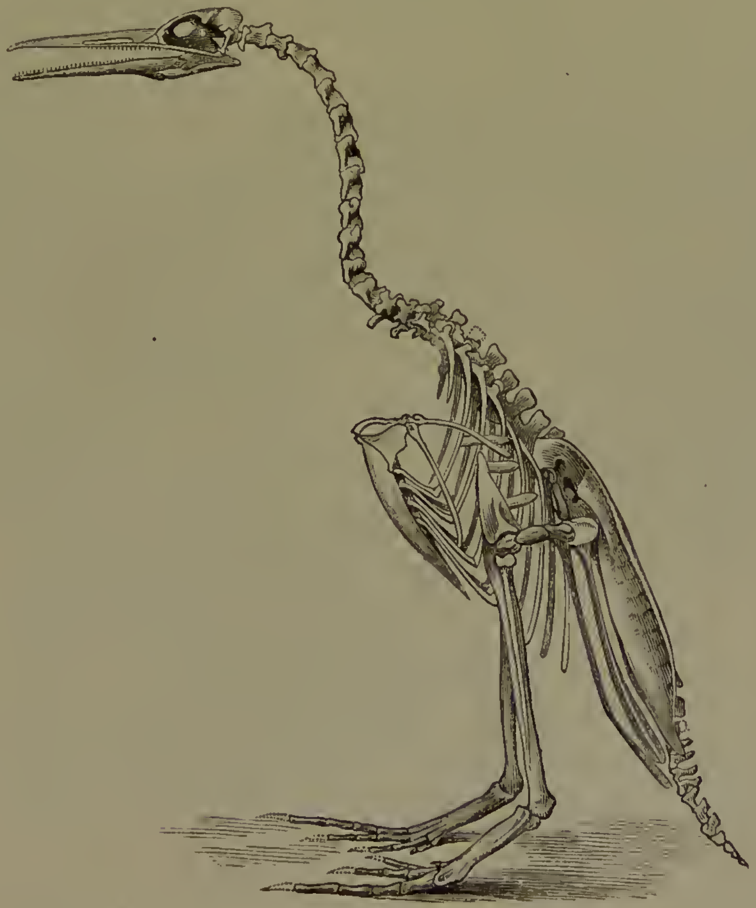

Fig. 93.—Odontornithes. Skeleton of *Hesperornis regalis*, restored. (After Marsh.) About one-tenth of the natural size.

CLASS V.—MAMMALIA (QUADRUPEDS).

SUB-CLASS I.—ORNITHODELPHIA.

ORDER I.—MONOTREMATA.

Fam. *a.* Ornithorhynchidæ.—*Ornithorhynchus* (Duck-mole, fig. 94).

Fam. *b.* Echidnidæ.—*Echidna.*

(Owen, Art. "*Monotremata,*" Todd's Cyclopædia Anat. and Phys., 1841 ; Meckel, *Ornithorhynchi paradoxi descriptio anatomica*, 1826 ; Waterhouse, *A Natural History of the Mammalia*, vol. i., London, 1846.)

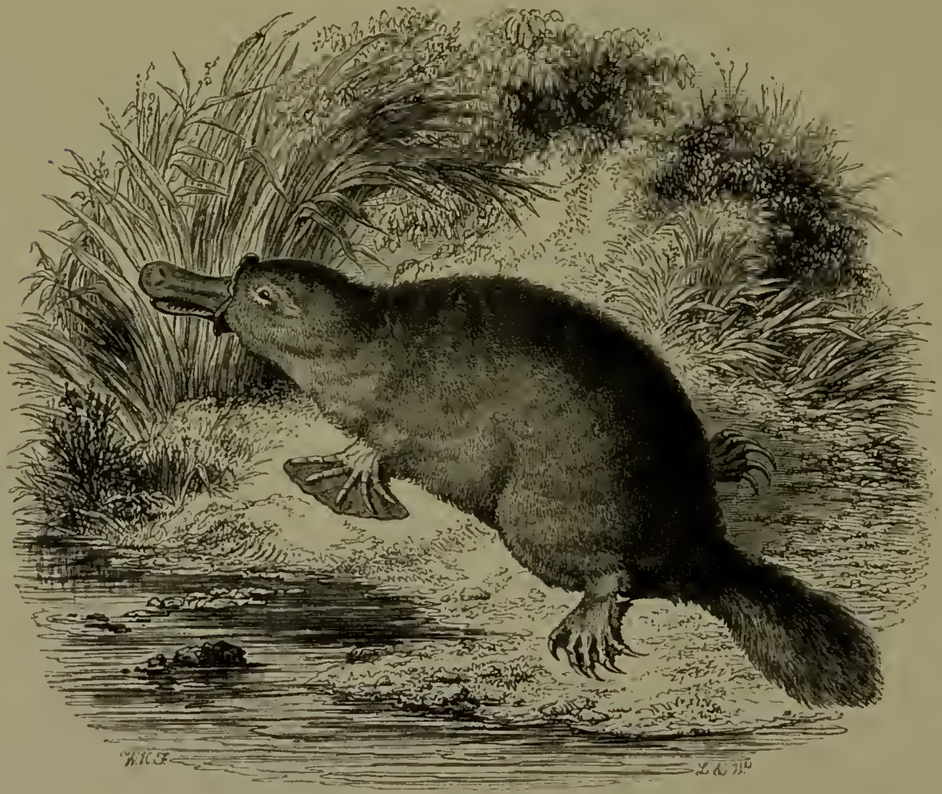

Fig. 94.—Monotremata. *Ornithorhynchus anatinus*, Australia.

SUB-CLASS II.—DIDELPHIA.

ORDER I.—MARSUPIALIA.

Sub-ord. 1. Diprotodontia.

Section Rhizophaga.

Fam. Phascolomydæ.—*Phascolomys* (Wombat).

Section Poëphaga.

Fam. Macropodidæ.—*Macropus* (Kangaroo), *Dendrolagus* (Tree-kangaroo), *Hypsiprymnus* (Kangaroo-rat).

Section Carpophaga.

Fam. *a.* Phascolarctidæ.—*Phascolarctos* (Koala).

Fam. *b.* Phalangistidæ (Phalangers).—*Phalangista*, *Petaurus.*

Sub-ord. 2. Polyprotodontia.

Section Entomophaga.

Fam. *a.* Peramelidæ.—*Perameles* (Bandicoot), *Chæropus.*

Fam. *b.* Didelphidæ.—*Didelphys* (Opossum), *Cheironectes.*

Section Sarcophaga.

Fam. Dasyuridæ.—*Thylacinus*, *Dasyurus.*

(Waterhouse, *A Natural History of the Mammalia*, vol. i., London, 1846; Owen, *Classification of the Marsupialia*, Trans. Zool. Soc., 1839; Owen, *Fossil Mammalia of Australia*, 1877; Gould, *The Mammals of Australia*, 1863.)

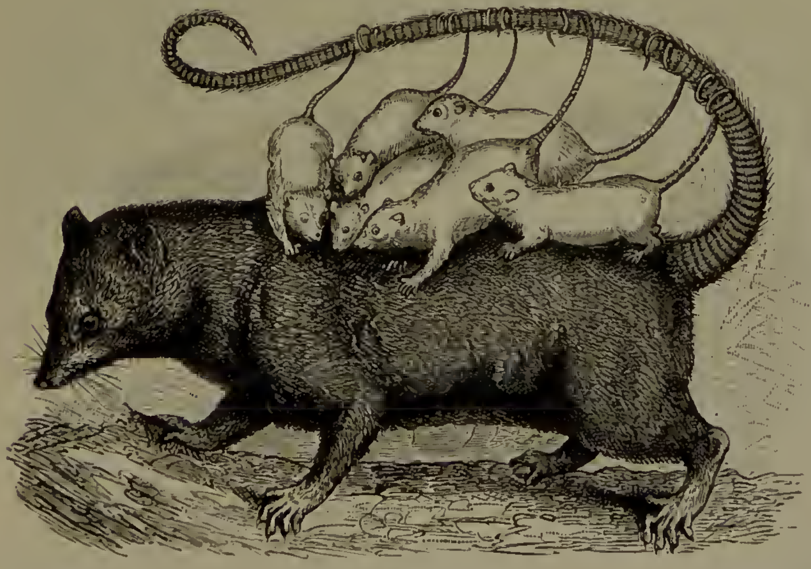

Fig. 95.—Marsupialia. The female of *Didelphys dorsigera*, one of the South American Opossums, carrying its young upon its back.

SUB-CLASS III.—MONODELPHIA.

ORDER I.—EDENTATA (BRUTA).

Sub-ord. 1. Tardigrada.
  Fam. Bradypodidæ (Sloths).—*Bradypus, Cholœpus.*
Sub-ord. 2. *Gravigrada.
  Fam. *Megatheridæ. — *Megatherium, Mylodon, Megalonyx.*
Sub-ord. 3. Loricata.
  Fam. *a.* Dasypodidæ (Armadillos).—*Dasypus, Chlamyphorus.*
  Fam. *b.* *Glyptodontidæ.—*Glyptodon.*
Sub-ord. 4. Vermilinguia.
  Fam. *a.* Myrmecophagidæ.—*Myrmecophaga* (Ant-eater), *Cyclothurus.*
  Fam. *b.* Manidæ.—*Manis* (Pangolin).
  Fam. *c.* Orycteropidæ.—*Orycteropus* (Aardvark).

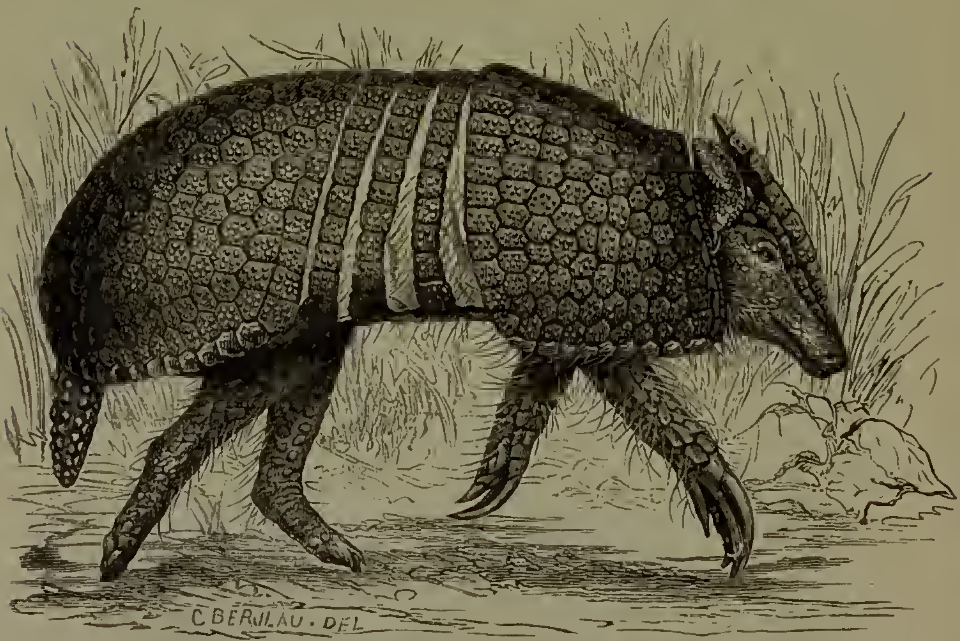

Fig. 96.—Edentata. The three-banded Armadillo (*Tolypeutes conurus*), one-third of the natural size. (After Murie.)

(Rapp, *Anatomische Untersuchungen über die Edentaten*, Tübingen, 1852; Turner, *Classification of the Edentata*, Proc. Zool. Soc., 1851; Jäger, *An-*

atomische Untersuchung des Orycteropus Capensis, Stuttgart, 1837 ; Owen, *Memoir on the Megatherium*, 1860 ; Murie, *On the Habits, Structure, and Relations of the Three-banded Armadillo*, Trans. Linn. Soc., 1872 ; Owen, *On the Anatomy of the Great Ant-Eater*, Trans. Zool. Soc., 1856-57.)

ORDER II.—SIRENIA.

Fam. Manatidæ (Sea-cows).—*Manatus* (Manatee), *Halicore* (Dugong), *Rhytina* (extinct within the historical period), **Halitherium.*

(Murie, *Form and Structure of the Manatee*, Trans. Zool. Soc., 1872 ; Owen, *Anatomy of the Dugong*, Proc. Zool. Soc., 1838.)

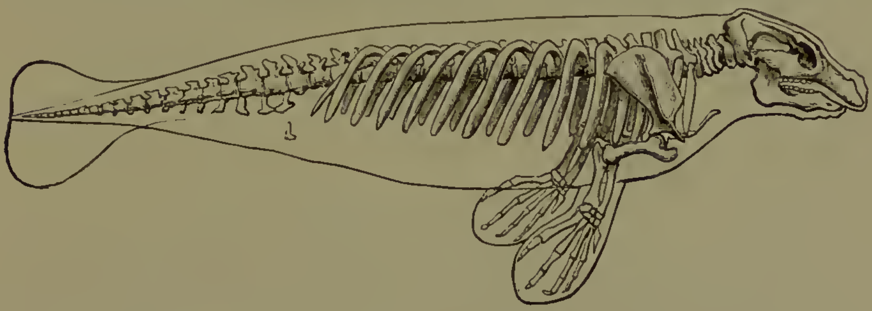

Fig. 97.—Sirenia. Skeleton of the Manatee (*Manatus Americanus*).

ORDER III.—CETACEA.

Sub-ord. 1. Mysticeti.

Fam. Balænidæ.—*Balæna* (Right Whale), *Balænoptera* (Rorqual).

Sub-ord. 2. Odontoceti.

Fam. *a.* Catodontidæ.—*Physeter* (Sperm-whale).
Fam. *b.* Delphinidæ. — *Delphinus* (Dolphin), *Phocæna* (Porpoise), *Platanista.*
Fam. *c.* Monodontidæ.—*Monodon* (Narwhal).
Fam. *d.* Rhynchoceti.—*Ziphius*, *Hyperoödon.*
Fam. *e.* *Zeuglodontidæ.—*Zeuglodon*, *Squalodon.*

(F. Cuvier, *Histoire naturelle des Cétacés*, Paris, 1836 ; Eschricht, *Untersuchungen über die nordischen Walthiere*, Leipzig, 1849 ; Gray, *Synopsis of the Species of Whales and Dolphins in the British Museum*, 1868 ; Flower, *Notes on the Skeletons of Whales*, Proc. Zool. Soc., 1864.)

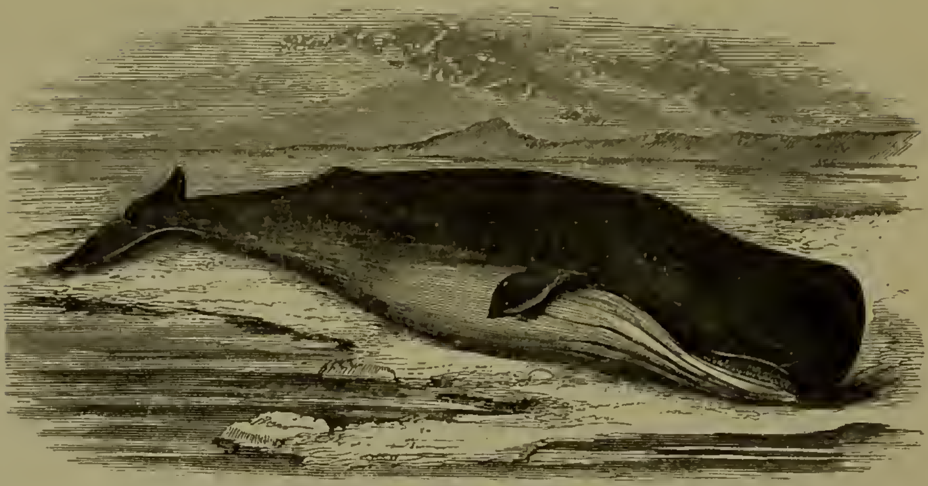

Fig. 98.—Cetacea. Spermaceti Whale (*Physeter macrocephalus*).

ORDER IV.—UNGULATA.

Section Perissodactyla (Odd-toed Ungulates).

Fam. *a.* *Coryphodontia.—*Coryphodon.*
Fam. *b.* Rhinocerotidæ.—*Rhinoceros.*
Fam. *c.* Tapiridæ.—*Tapirus* (Tapir).
Fam. *d.* *Brontotheridæ.—*Brontotherium.*
Fam. *e.* *Palæotheridæ.—*Palæotherium.*
Fam. *f.* *Macrauchenidæ.—*Macrauchenia.*
Fam. *g.* Equidæ.—*Equus* (Horse), *Asinus* (Ass, Zebra), **Orohippus*, **Hipparion.*

Section Artiodactyla (Even-toed Ungulates).

Sub-ord. 1. Omnivora (Bunodonta).

Fam. *a.* Hippopotamidæ.—*Hippopotamus.*
Fam. *b.* Suida.—*Sus* (Pig), *Dicotyles* (Peccary), *Phacochœrus* (Wart-hog).
Fam. *c.* *Anoplotheridæ.—*Anoplotherium.*
Fam. *d.* *Oreodontidæ.—*Oreodon.*

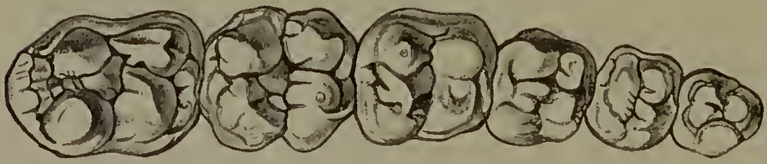

Fig. 99.—Grinding surface of the molar and præmolar teeth of a Peccary (*Dicotyles labiatus*), showing the bunodont type of dentition. (After Giebel.)

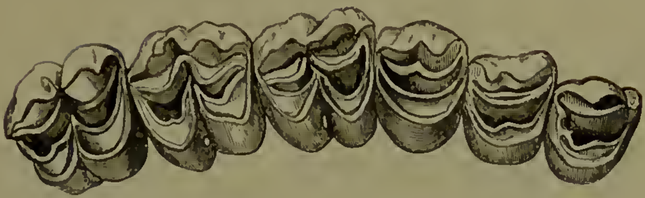

Fig. 100.—Grinding surface of the molar and præmolar teeth of the Giraffe (*Camelopardalis Giraffa*), showing the selenodont type of dentition.

Sub-ord. 2. Ruminantia (Selenodonta).

Fam. *a.* Camelidæ (Tylopoda). — *Camelus* (Camel), *Auchenia* (Llama).

Fam. *b.* Tragulidæ (Chevrotains).—*Tragulus, Hyomoschus.*

Fam. *c.* Cervidæ (Deer).—*Cervus, Dama, Alces.*

Fam. *d.* Camelopardalidæ.—*Camelopardalis* (Giraffe).

Fam. *e.* Antilopidæ (Antelopes). — *Rupicapra, Antilocapra.*

Fam. *f.* Ovidæ.—*Ovis* (Sheep), *Capra* (Goat).

Fam. *g.* Bovidæ.—*Bos* (Ox), *Ovibos* (Musk-ox), *Bubalus* (Buffalo).

(Cuvier, *Recherches sur les Ossemens fossiles*, Paris, 1846 ; Giebel, *Die Saügethiere in zoologischer, anatomischer, und palæontologischer Beziehung*, Leipzig, 1859 ; Flower, *Osteology of the Mammalia*, 1876 ; Owen, *Anatomy and Physiology of Vertebrated Animals*, vols. ii. and iii., 1866 and 1868 ; Pander and D'Alton, *Die Skelete der Wiederkaüer ;* Rütimeyer, *Versuch einer natürlichen Geschichte des Rindes in seinen Beziehungen zu den Wiederkaüern im Allgemeinen*, 1866 ; Nathusius, *Die Racen des Schweines*, Berlin, 1860.)

ORDER V.—*DINOCERATA.—*Dinoceras.*

(Marsh, *Principal Characters of the Dinocerata*, Amer. Journ. Sci. and Arts, 1876.)

ORDER VI.—*TILLODONTIA.—*Tillotherium.*

(Marsh, *Principal Characters of the Tillodontia*, Amer. Journ. Sci. and Arts, 1876.)

ORDER VII.—*TOXODONTIA.—*Toxodon.*

(Owen, *Fossil Mammalia of the Voyage of the Beagle*, 1840.)

ORDER VIII.—HYRACOIDEA.

Fam. Hyracidæ.—*Hyrax.*

(Owen, *On the Anatomy of the Cape Hyrax*, Proc. Zool. Soc., 1832 ; Schreber, *Naturgeschichte der Saügethiere*, 1775-1855.)

ORDER IX.—PROBOSCIDEA.

Fam. *a.* Elephantidæ.—*Elephas*, **Mastodon.*
Fam. *b.* *Deinotheridæ.—*Deinotherium.*

(Cuvier, *Recherches sur les Ossemens fossiles*, Paris, 1846 ; Mayer, *Beiträge zur anatomie des Elephanten*, Nova Acta, 1847 ; Kaup, *Deinotherium giganteum*, Isis, Bd. IV., 1829 ; Falconer, *Palæontological Memoirs*, 1868 ; Leith Adams, *Monograph of the British Fossil Elephants*, Palæontograph. Soc., 1877-78.)

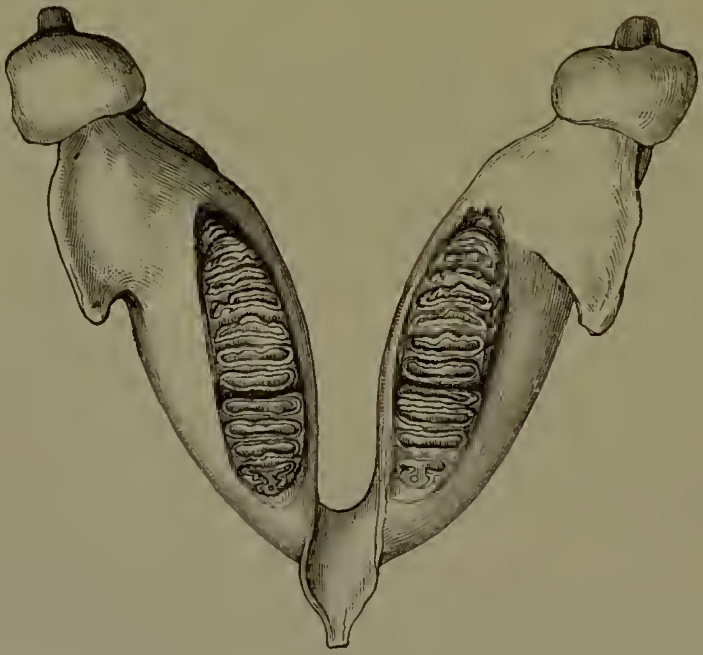

Fig. 161.—Lower jaw of the Indian Elephant (*Elephas Indicus*), viewed from above, showing the molar teeth. Greatly reduced in size.

Order X.—Carnivora (Feræ).

Sub-ord. 1. Pinnipedia.

Fam. *a.* Phocidæ (Seals).—*Phoca*, *Cystophora* (Sea-elephant), *Halichœrus*.
Fam. *b.* Otariidæ (Eared-seals).—*Otaria*.
Fam. *c.* Trichecidæ.—*Trichecus* (Walrus).

Sub-ord. 2. Plantigrada.

Fam. *a.* Ursidæ (Bears).—*Ursus*, *Helarctos* (Sun-bear).
Fam. *b.* Procyonidæ.—*Procyon* (Racoon), *Nasua* (Coati, fig. 102), *Bassaris*.
Fam. *c.* Cercoleptidæ.—*Cercoleptes* (Kinkajou).
Fam. *d.* Æluridæ.—*Ælurus* (" Panda ").
Fam. *e.* Melidæ (Badgers).—*Meles*, *Mellivora* (Honey-badger).

Sub-ord. 3. Digitigrada.

Fam. *a.* Mustelidæ.—*Putorius* (Weasel and Polecat), *Mustela* (Marten), *Lutra* (Otter).
Fam. *b.* Viverridæ. — *Viverra* (Civet-cat), *Herpestes* (Ichneumon).
Fam. *c.* Hyænidæ.—*Hyæna*, *Proteles* (Aardwolf).
Fam. *d.* Canidæ.—*Canis* (Dog, Wolf, &c.), *Vulpes* (Fox).
Fam. *e.* Felidæ.—*Felis* (Cat, Lion, &c.), *Lynx* (Lynx), **Machairodus*.

On the classification adopted by Prof. Flower, the *Carnivora* are divided into the three following sections, the *Pinnipedia* being left out: (1), Arctoidea, comprising the *Ursidæ*, *Procyonidæ*, *Æluridæ*, and *Mustelidæ*. (2) Cynoidea, comprising only the family of the *Canidæ*. (3) Æluroidea, comprising the *Viverridæ*, *Hyænidæ*, *Cryptoproctidæ*, and *Felidæ*.

(Strauss-Durckheim, *Anatomie descriptive et comparative du Chat*, Paris 1845 ; St. George Mivart, *The Cat*, 1881 ; Flower, *On the Value of the Characters of the Base of the Cranium in the Classification of the Order Carnivora*, Proc. Zool. Soc., 1869 ; Allen, *Monograph of the North American Pinnipeds*, Washington, 1880 ; Bell, Art. "*Carnivora*," Todd's Cyclopædia Anat. and Phys., 1835.)

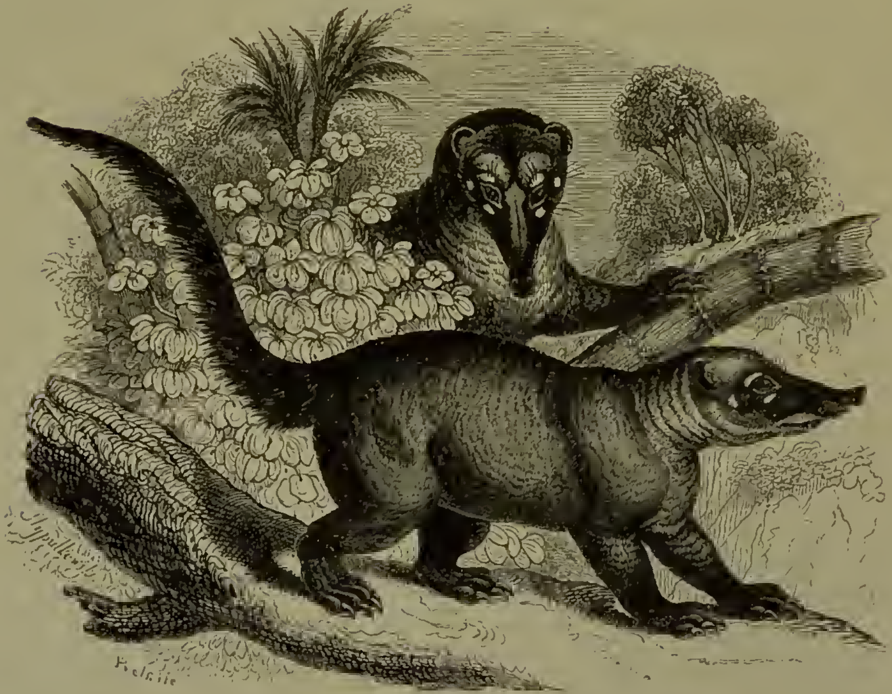

Fig. 102.—Carnivora. *Nasua fusca*, the Brown Coati.

ORDER XI.—RODENTIA (GLIRES).

- Sub-ord. 1. Duplicidentata.
  - Fam. *a*. Leporidæ.—*Lepus* (Hare and Rabbit).
  - Fam. *b*. Lagomydæ.—*Lagomys* (Pika).
- Sub-ord. 2. Simplicidentata.
  - Fam. *a*. Caviidæ.—*Cavia* (Cavy), *Hydrochœrus* (Capybara), *Dasyprocta* (Agouti).
  - Fam. *b*. Hystricidæ.—*Hystrix* (Porcupine).
  - Fam. *c*. Cercolabidæ.—*Cercolabes*.
  - Fam. *d*. Octodontidæ.—*Octodon*, *Ctenomys*, *Myopotamus* (Coypu).
  - Fam. *e*. Chinchillidæ.—*Chinchilla*.
  - Fam. *f*. Castoridæ.—*Castor* (Beaver).
  - Fam. *g*. Saccomydæ.—*Geomys* (Gopher).
  - Fam. *h*. Spalacidæ.—*Spalax* (Mole-rat).
  - Fam. *i*. Muridæ.—*Mus* (Rat, Mouse), *Myodes* (Lemming).

Fam. *j*. Dipodidæ.—*Dipus* (Jerboa).
Fam. *k*. Myoxidæ.—*Myoxus* (Dormouse).
Fam. *l*. Sciuridæ.—*Sciurus* (Squirrel), *Arctomys* (Marmot).

Sub-ord. 3. Hebedidentata.
Fam. *Mesotheriidæ.—*Mesotherium.*

(Waterhouse, *A Natural History of the Mammalia*, vol. ii., Rodentia, London, 1838; Lilljeborg, *Systematisk Öfversigt af de gnagande Däggjuren, Glires*, 1866; Alston, *On the Classification of the Order Glires*, Proc. Zool. Soc., 1876; Coues and Allen, *Monographs of the North American Rodentia* Washington, 1877.)

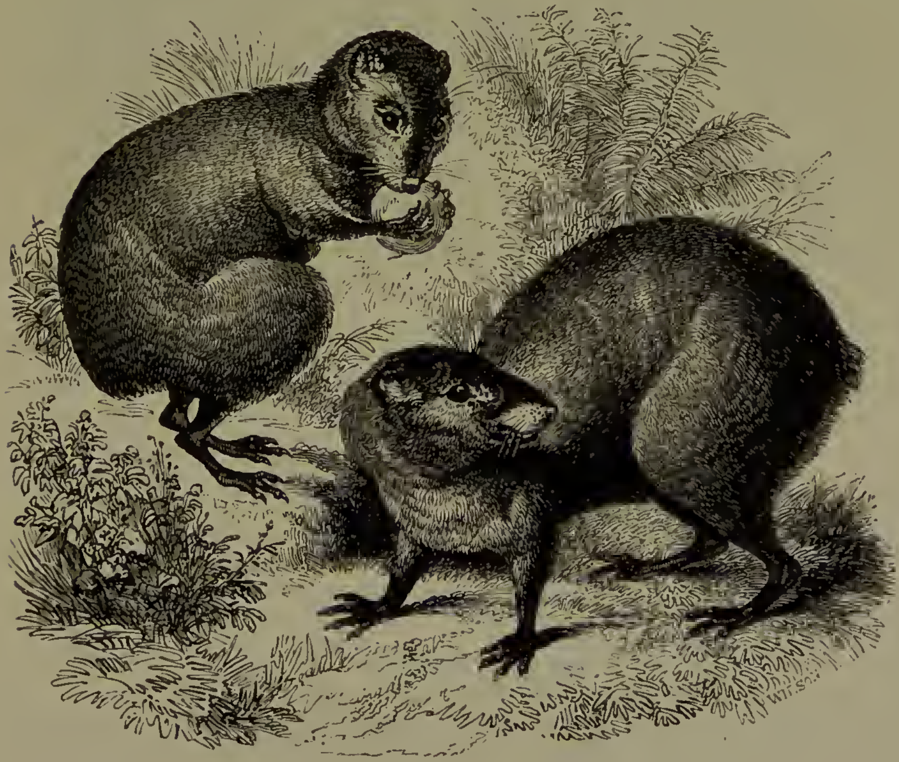

Fig. 103.—Rodentia. The Agouti (*Dasyprocta aguti*).

ORDER XII. CHEIROPTERA (BATS).

Sub-ord. 1. Insectivora (Microcheiroptera).
Fam. *a*. Vespertilionidæ.—*Vespertilio, Plecotus.*
Fam. *b*. Rhinolophidæ.—*Rhinolophus* (Horse-shoe Bat).
Fam. *c*. Noctilionidæ.—*Emballonura.*
Fam. *d*. Phyllostomidæ.—*Phyllostoma.*

Sub-ord. 2. Frugivora (Megacheiroptera).

Fam. Pteropidæ.—*Pteropus* (Fox-bat).

(Dobson, *Monograph of the Asiatic Cheiroptera*, 1876; Bell, Art. "*Cheiroptera*," Todd's Cyclopædia Anat. and Phys., 1835; Blasius, *Naturgeschichte der Saügethiere Deutschlands*, Braunschweig, 1857.)

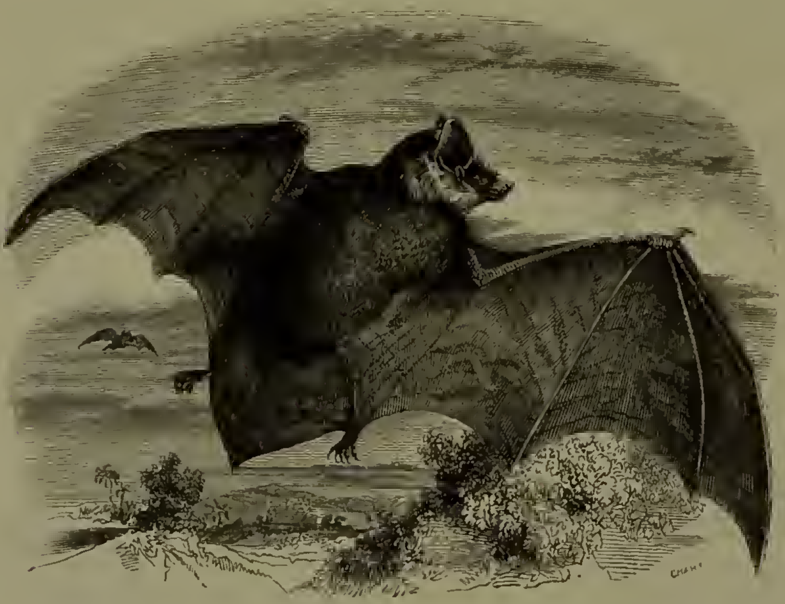

Fig. 104.—Cheiroptera. *Vespertilio discolor*, one-half the natural size.

ORDER XIII.—INSECTIVORA.

Fam. *a.* Talpidæ.—*Talpa* (Mole), *Condylura*, *Chrysochloris* (Golden-mole).
Fam. *b.* Potamogalidæ.—*Potamogale*.
Fam. *c.* Soricidæ.—*Sorex* (Shrew-mouse), *Myogale* (Desman).
Fam. *d.* Erinaceidæ.—*Erinaceus* (Hedgehog).
Fam. *e.* Centetidæ.—*Centetes*, *Ericulus*.
Fam. *f.* Tupaiidæ.—*Tupaia* (Banxring).
Fam. *g.* Macroscelidæ.—*Macroscelcs* (Elephant-shrew).
Fam. *h.* Galeopithecidæ.—*Galeopithecus* (Flying-lemur).

(Mivart, *Classification of the Insectivora*, Proc. Zool. Soc., 1871—also on the *Osteology of the Insectivora*, Journ. Anat. and Phys., vol. ii.; Allman, *On the Characters and Affinities of Potamogale*, Trans. Zool. Soc., 1866; Fitzinger, *Ueber die Naturliche Familie der Igel* (*Erinacci*), Sitzb. der K. Akad. Wiss. Wien, 1867, with papers on the *Macroscelidæ* and *Soricidæ;* Fitzinger, *Die natürliche Familie der Maulwürfe* (*Talpæ*), ibid., 1869; Gill, *Synopsis of Insectivorous Mammalia*, Bull. U.S. Geol. Survey, 1875; Coues, *Precursory Notes on American Insectivorous Mammals*, Bull. U.S. Geol. Survey, 1877.)

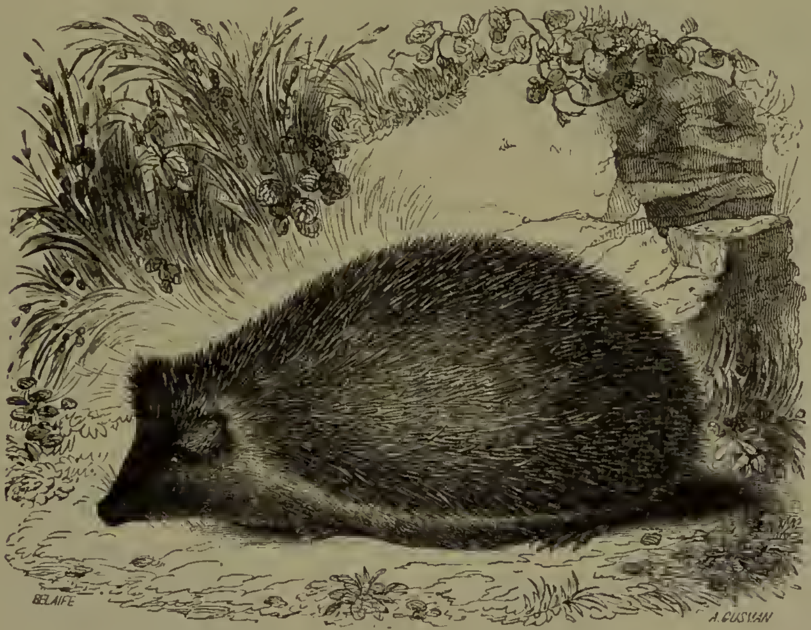

Fig. 105.—Insectivora. The Hedgehog (*Erinaceus Europæus*).

ORDER XIV.—QUADRUMANA (MONKEYS).

Sub-ord. 1. Strepsirhina (Prosimiæ).

Fam. *a.* Cheiromydæ.—*Cheiromys* (Aye-Aye).
Fam. *b.* Tarsiidæ.—*Tarsius.*
Fam. *c.* Nycticebidæ.—*Nycticebus, Stenops.*
Fam. *d.* Lemuridæ.—*Lemur, Indris* (Indri), *Galago.*

Sub-ord. 2. Platyrhina.

Fam. *a.* Hapalidæ.—*Hapale* (Marmoset), *Midas.*
Fam. *b.* Cebidæ.—*Cebus* (Capuchin-monkey), *Ateles* (Spider-monkey), *Mycetes* (Howler).

Sub-ord. 3. Catarhina.

Fam. *a.* Semnopithecidæ.—*Semnopithecus, Cercopithecus, Macacus* (Macaque), *Rhesus.*
Fam. *b.* Cynocephalidæ (Baboons).—*Cynocephalus.*
Fam. *c.* Simiidæ.—*Hylobates* (Gibbon), *Troglodytes* (Gorilla, Chimpanzee), *Simia* (Orang).

(Mivart, Art. "*Apes,*" Encyclo. Brit., 9th ed., 1875; Mivart, *Appendicular Skeleton of Primates,* Phil. Trans., 1867; Mivart, *The Zoological Rank of the Lemuroidea,* Proc. Zool. Soc., 1873; Owen, *Monograph on the Aye-Aye,* 1863; Owen, *Memoir on the Gorilla,* 1865; Vrolik, *Recherches sur le Chimpansé,* 1841.)

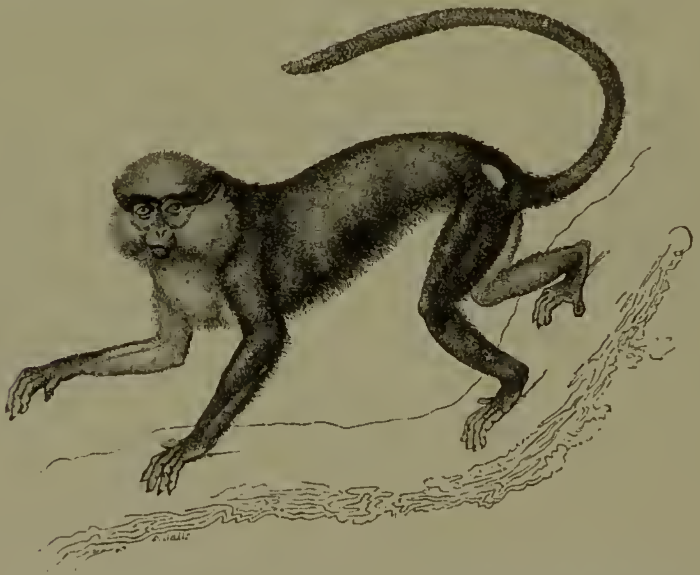

Fig. 106.—Quadrumana. *Cercocebus mona,* one-seventh of the natural size.

ORDER XV.—BIMANA.—*Homo* (Man).

(Pritchard, *Natural History of Man,* 1843; Darwin, *Descent of Man,* 1871; Nott and Gliddon, *Types of Mankind,* 1854; Tylor, *Anthropology, an Introduction to the Study of Man and Civilisation,* 1881; Lubbock, *Prehistoric Times,* 2d ed., 1869.)

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